

1-32 GENERAL INFORMATION

*Mark ... Isuzu genuine lubricants

LUBRICATION	TYPE OF LUBRICANT	MAKE AND BRAND
Injection pump governor	Hydromaster and airmaster paste	BP SHOCK ABSORBER OIL CALTEX CAPELLA OIL 22WF CASTROL ICEMATIC 44 CHEVRON REFRIGERATION OIL 32 ENI AGIP F.1 TER 34 ENI AGIP F.1 SHOCK ABSORBER ESSO ZERICE 15 MOBIL GARGOYLE ARCTIC OIL LIGHT SHELL CLAVUS OIL 17 SUN SUMISO GS OIL SUNFILL M-3310 TEXACO CAPELLA OIL 22WF TOTAL LUNARIA 46
Engine cooling system	Permanent type anti- freeze solution	*ISUZU ANTI-FREEZE PT BP ANTIFROST CALTEX AF COOLANT CASTROL ANTI-FREEZE CHEVRON ATLAS PERMA-GUARD ANTI-FREEZE AND COOLANT ENI AGIP F.1 ANTI-FREEZE ESSO RAD MOBIL PERMAZONE SHELLZONE SHELL GLYCOSHELL PLUS SHELLSAFE TEXACO ANTI-FREEZE COOLANT TEXACO STARTEX ANTI-FREEZE COOLANT TOTAL ANTIGEL UNION YEAR AROUND ANTI-FREEZE AND COOLANT

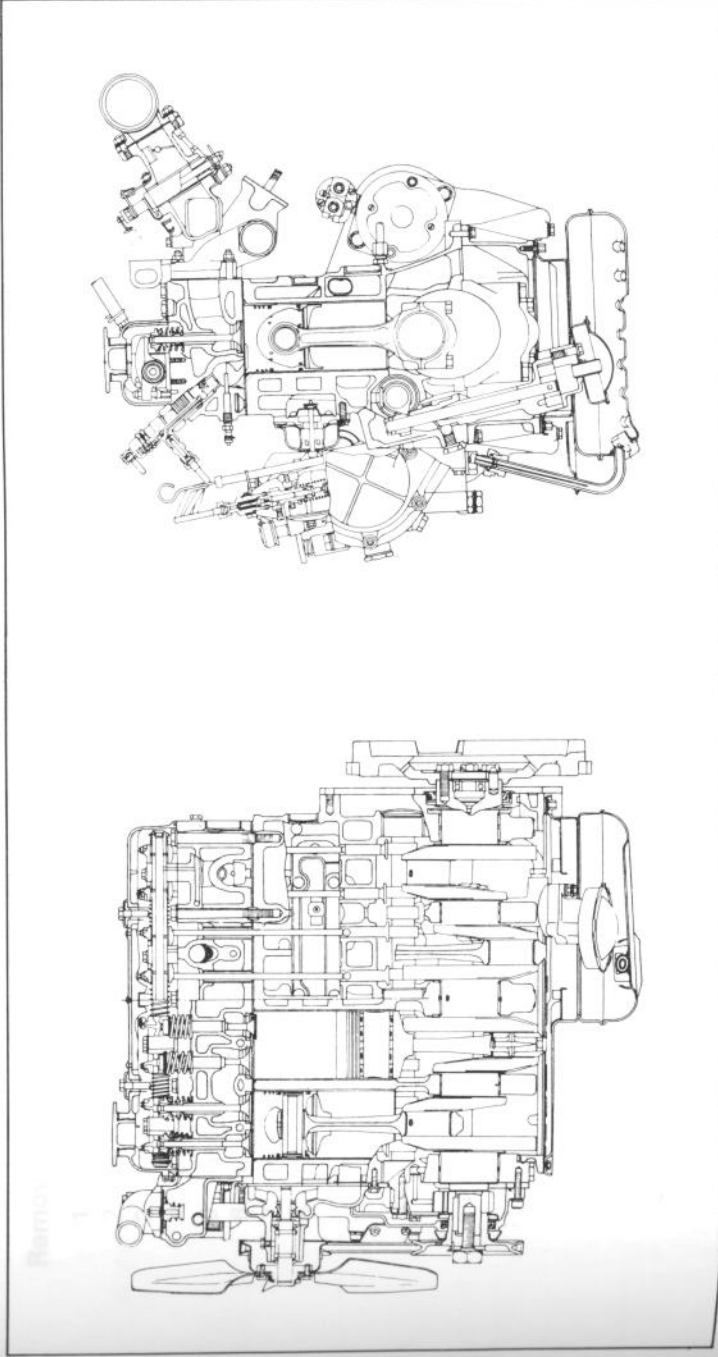
SECTION 2
ENGINE ASSEMBLY

INDEX

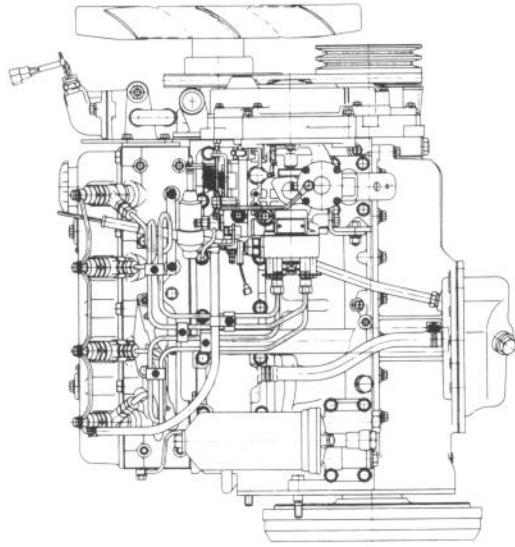
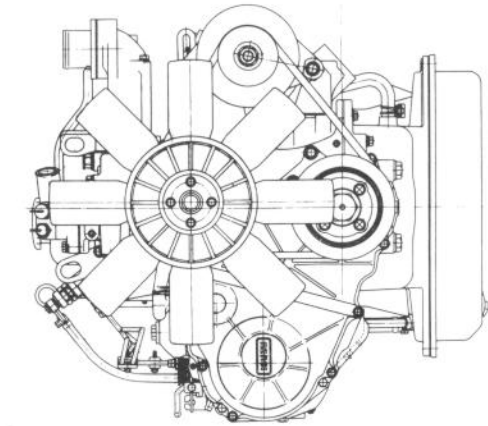
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GENERAL DESCRIPTION

C190 C240 models



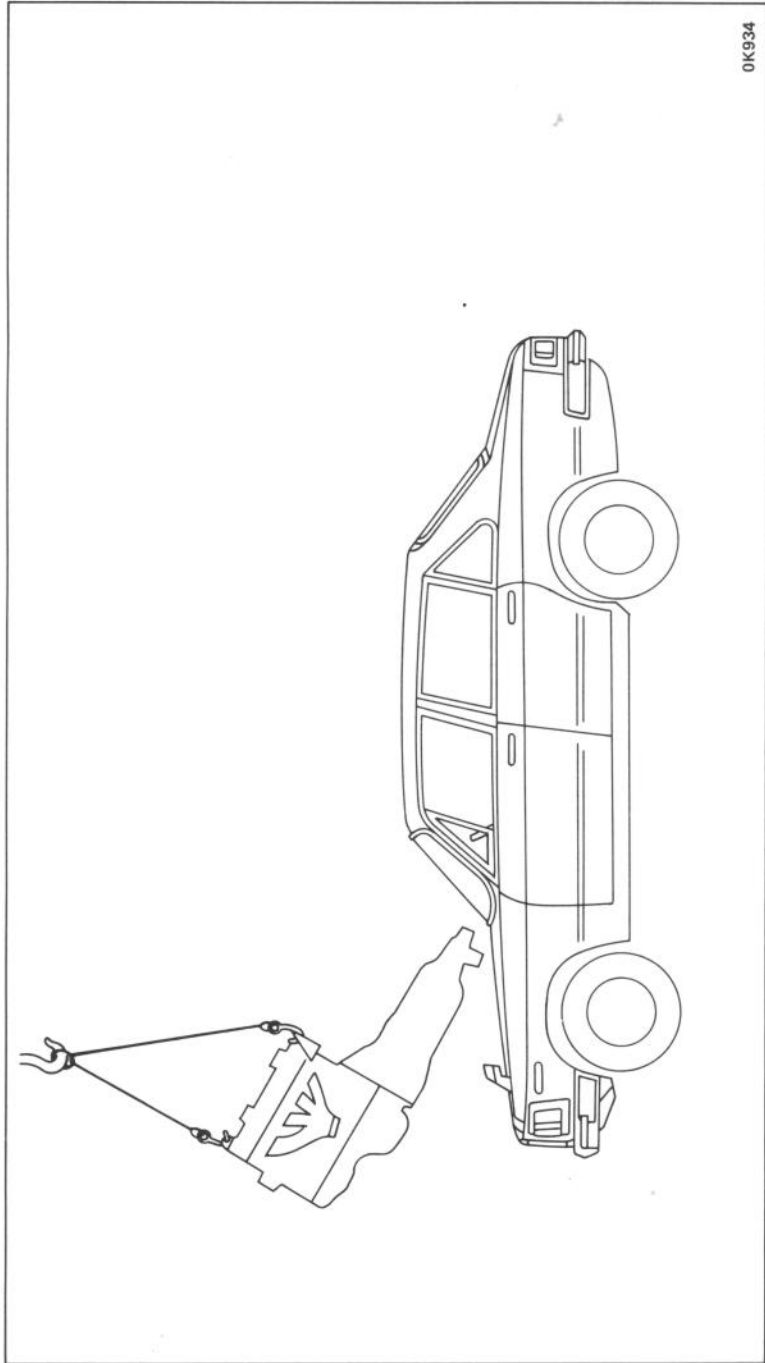
C190GB model



REMOVAL AND INSTALLATION

This section deals only with major service operations and major component parts removal and installation.

PASSENGER CAR



OK934

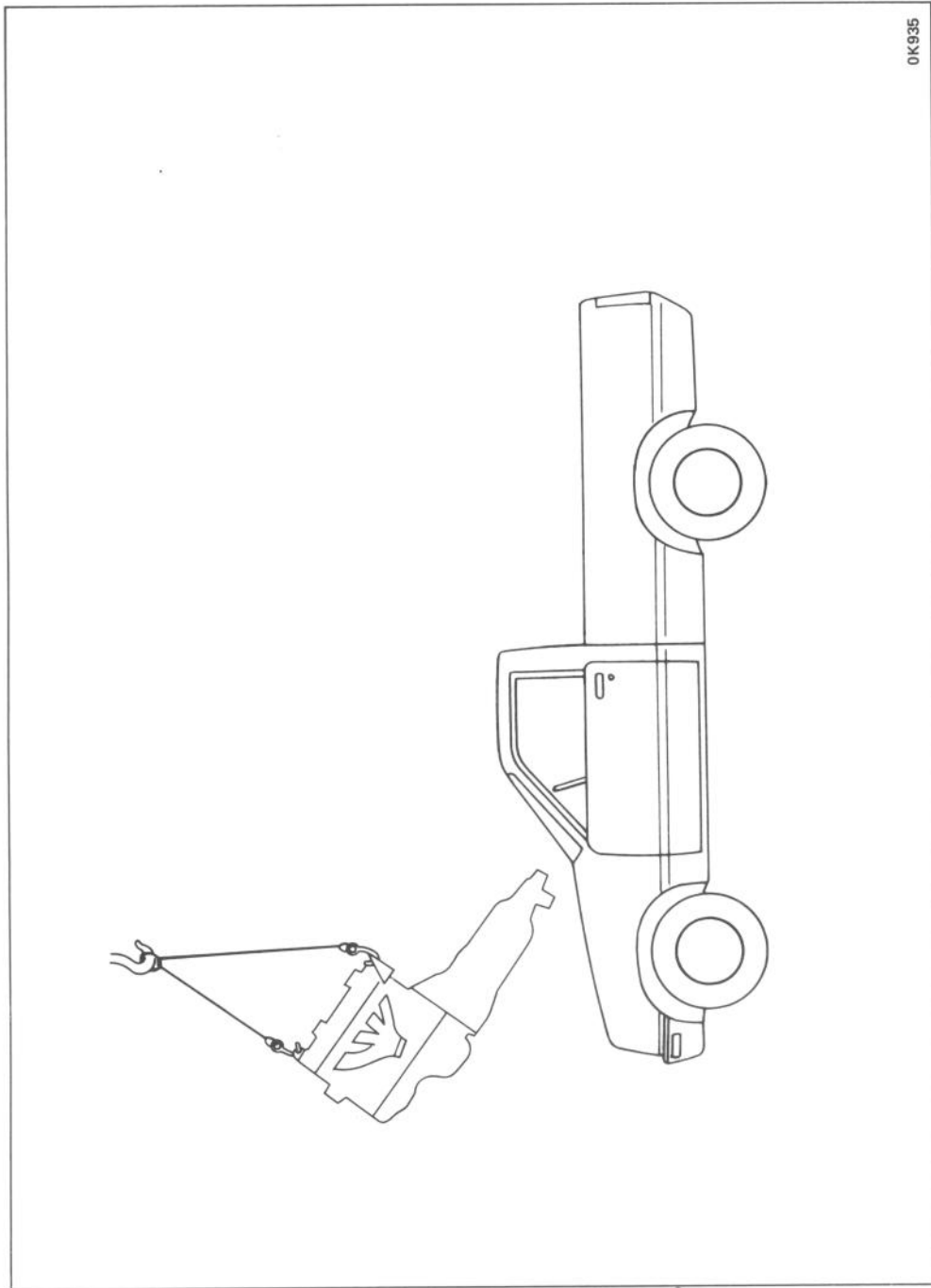
Removal steps

1. Battery cable
2. Engine hood
3. Fan and fan shroud
4. Exhaust pipe
5. Gearshift lever
6. Clutch cable
7. Propeller shaft
8. Engine

Installation steps

To install, follow the removal procedure in reverse order.

LIGHT-DUTY-TRUCK (KBD 4 x 2 model)



OK935

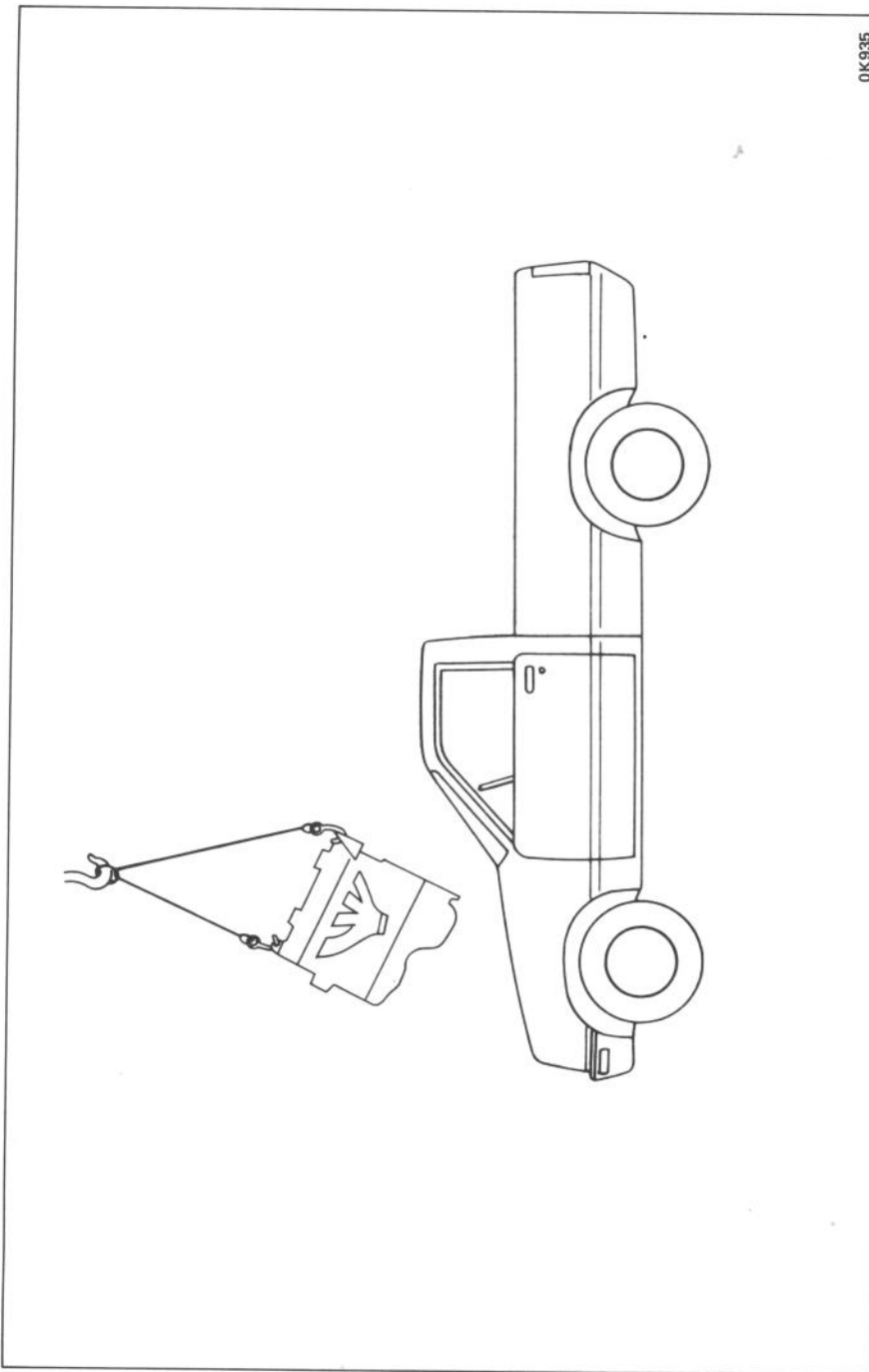
Removal steps

1. Battery
2. Engine hood
3. Fan and fan shroud
4. Exhaust pipe
5. Gearshift lever
6. Clutch cable
7. Propeller-shaft
8. Engine with transmission

Installation steps

To install, follow the removal procedure in reverse order.

LIGHT DUTY-TRUCK (KBD 4 x 4 model)



OK935

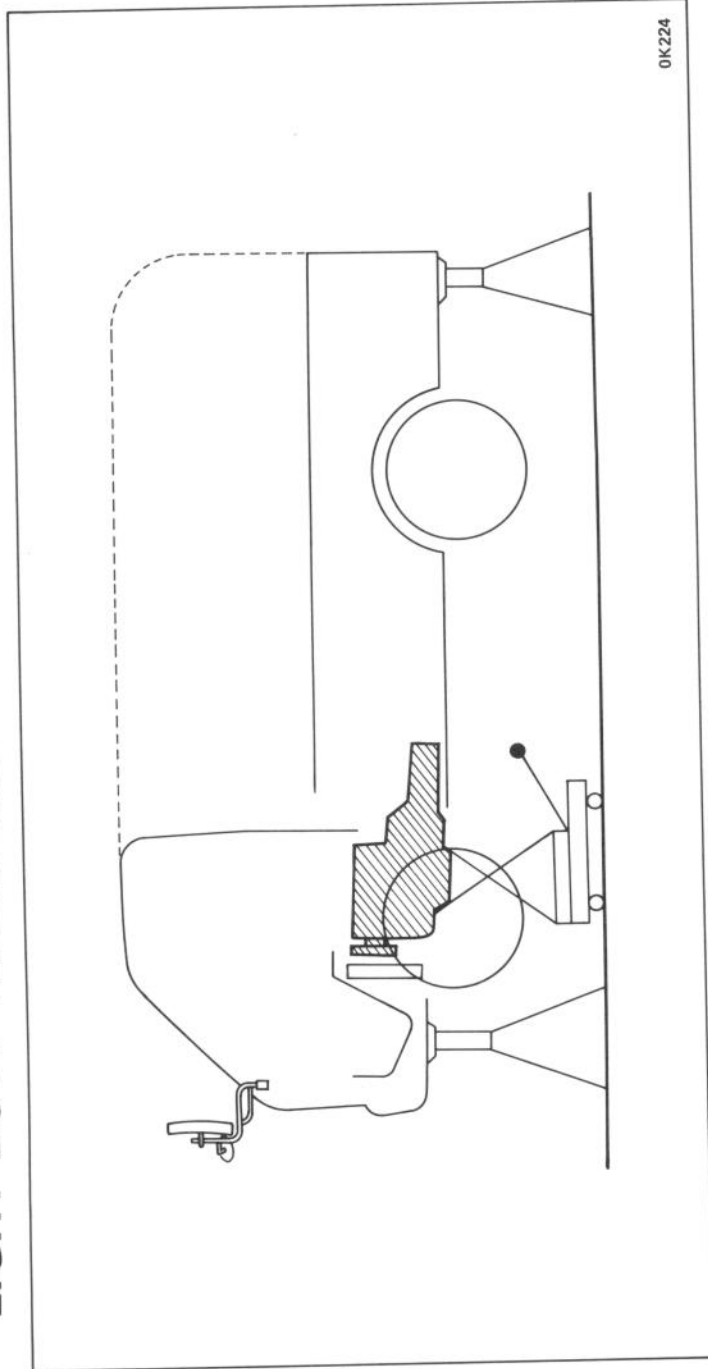
Removal steps

1. Battery cable
2. Engine hood
3. Fan and fan shroud
4. Exhaust pipe
5. Gearshift lever
6. Qudardrand box
7. Clutch cable
8. Propeller shaft
9. Starter motor
10. Transmission rear mounting and bracket
11. Transfer side case
12. Transmission
13. Engine

Installation steps

To install, follow the removal procedure in reverse order.

LIGHT-DUTY-TRUCK AND BUS (KAD and TLD models)



Removal steps

- ▲ 1. Battery cable and electrical cable
- ▲ 2. Engine cover
- ▲ 3. Radiator hose and heater hose
4. Intake pipe vacuum hose and fuel pipe
5. Engine control cable
6. Exhaust pipe
7. Tie rod
8. Transmission control rod
9. Clutch slave cylinder
10. Speedometer cable
11. Parking brake cable
12. Propeller shaft
13. Exhaust pipe bracket
- ▲ 14. Engine foot bracket
15. Transmission mount bracket
- ▲ 16. Engine with transmission
17. Engine

Installation steps

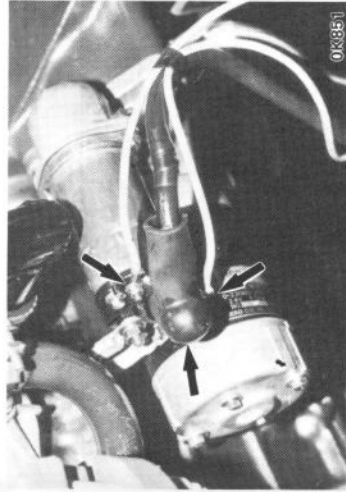
1. Engine
- ▲ 2. Engine with transmission
- ▲ 3. Transmission mount bracket
- ▲ 4. Engine foot bracket
- ▲ 5. Exhaust pipe bracket
- ▲ 6. Propeller shaft
7. Parking brake cable
8. Speedometer cable
9. Clutch slave cylinder
10. Transmission control rod
- ▲ 11. Tie rod
- ▲ 12. Exhaust pipe
13. Engine control cable
14. Intake pipe, vacuum hose and fuel pipe
15. Radiator hose and heater hose
16. Engine cover
17. Battery cable and electrical cable



Important operations — Removal

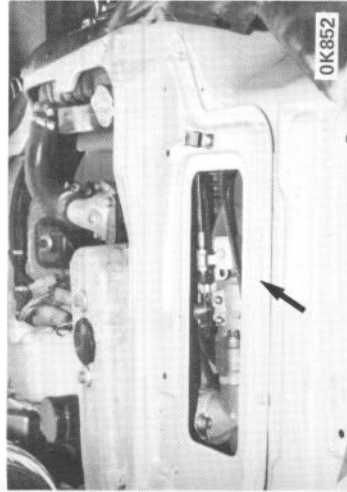
1. Battery cable and electrical cable

Disconnect the cables.



2. Engine cover

1. Raise the companion's seat.
2. Remove the driver seat cushion, then remove the engine cover.

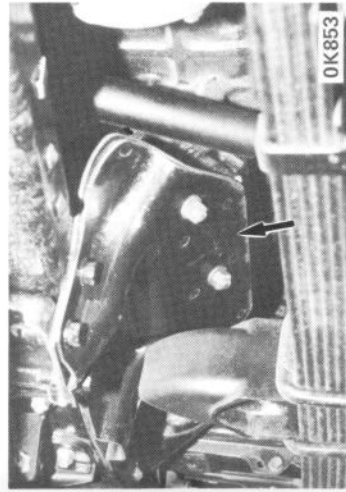


3. Radiator hose and heater hose

When the engine and radiator are filled with long life coolant, drain and keep the coolant in a clean container.

14. Engine foot bracket

Support the engine on a transmission jack.

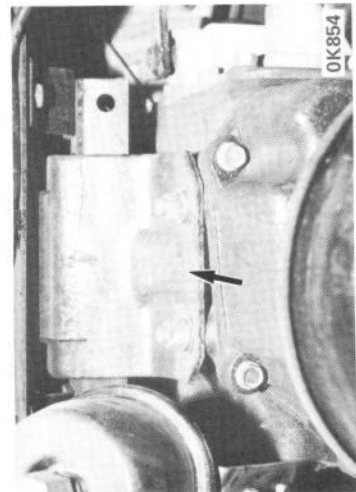


16. Engine with transmission

Removal of transmission assembly and clutch.

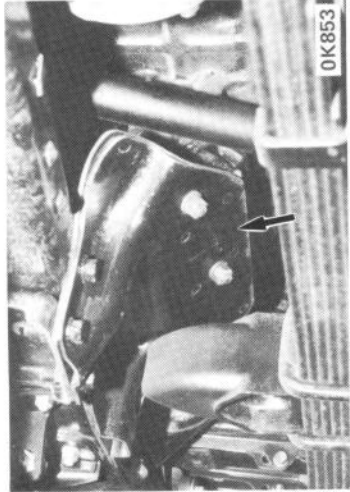
Refer to transmission and clutch workshop manuals for removal procedure.

Important operations — Installation



3. Transmission mount bracket

Torque	(kg-m)	2.8 — 4.7
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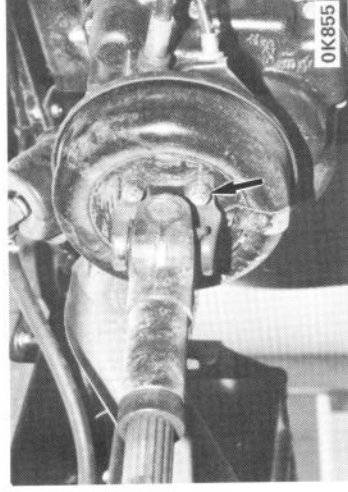
4. Engine foot bracket

Torque	(kg-m)	2.8 — 4.7
--------	--------	-----------



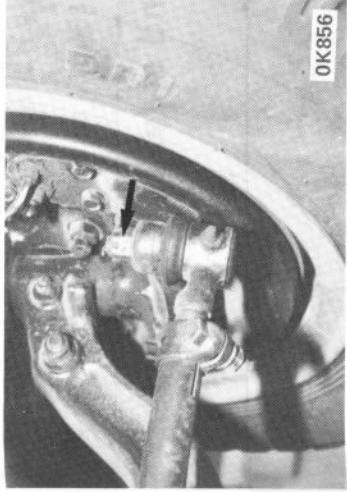
5. Exhaust pipe bracket

Torque	(kg-m)	1.7
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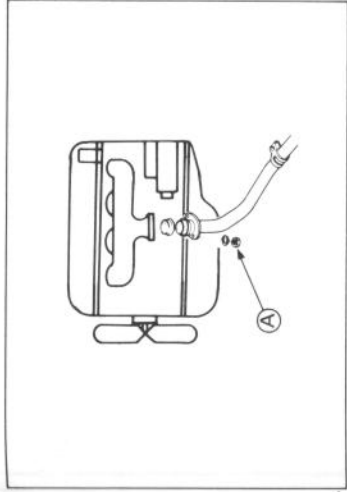
6. Propeller shaft

Torque	(kg-m)	4 — 6
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11. Tie rod

Torque	(kg-m)	6 — 9
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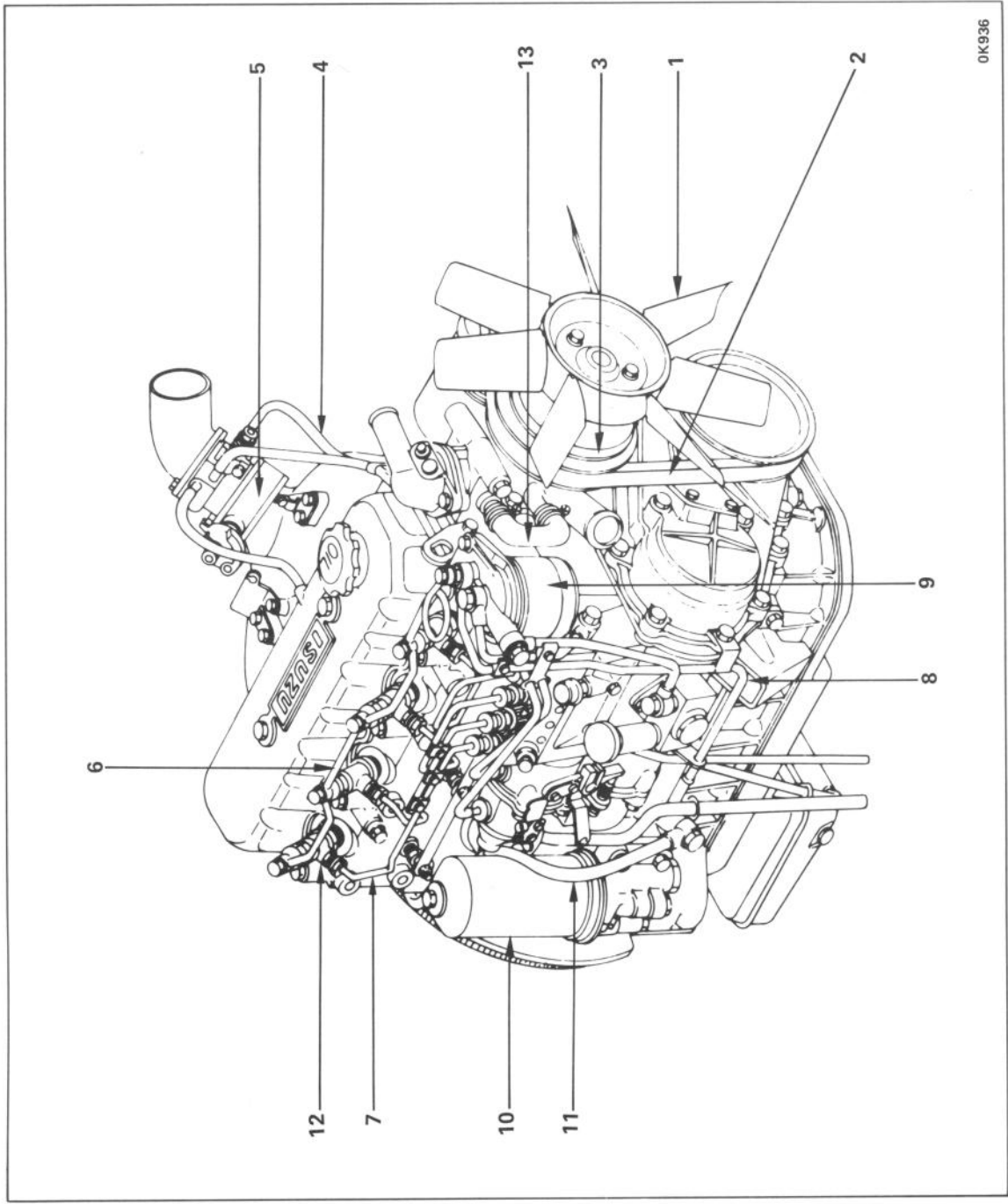
12. Exhaust pipe

Torque	(kg-m)	3.8
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 **DISASSEMBLY**

EXTERNAL PARTS (Right hand side) I

This illustration is based on the C240 model.



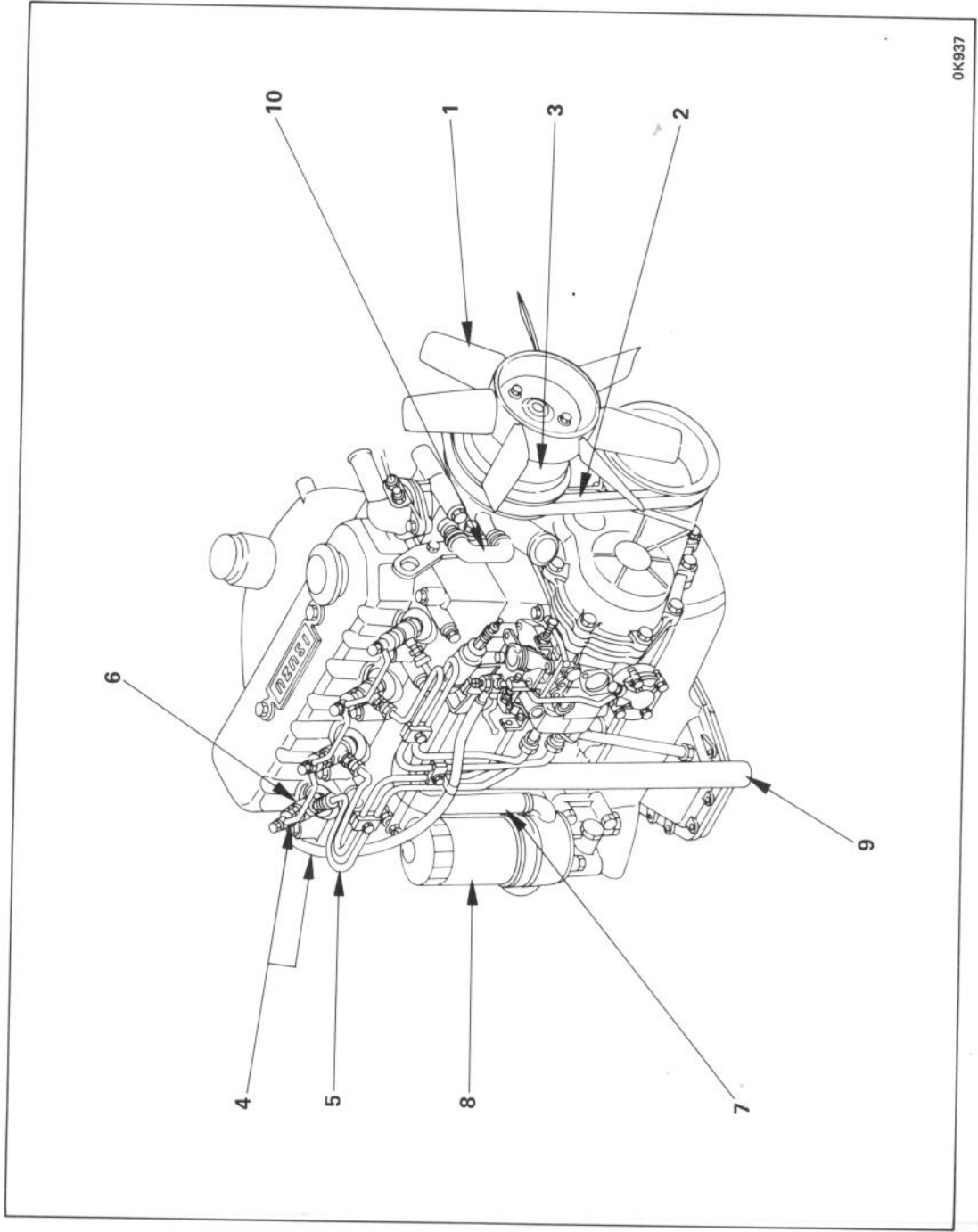
Disassembly steps

1. Cooling fan
2. Fan belt
3. Fan pulley
4. Vacuum hose
5. Intake shutter and throttle valve
6. Leak off pipe
7. Injection pipe

8. Fuel pipe
9. Fuel filter
10. Oil filter
11. Oil pipe : Oil gallery to vacuum pump
12. Injection nozzle
13. Water hose

EXTERNAL PARTS (Right hand side) II

This illustration is based on the C190GB model.

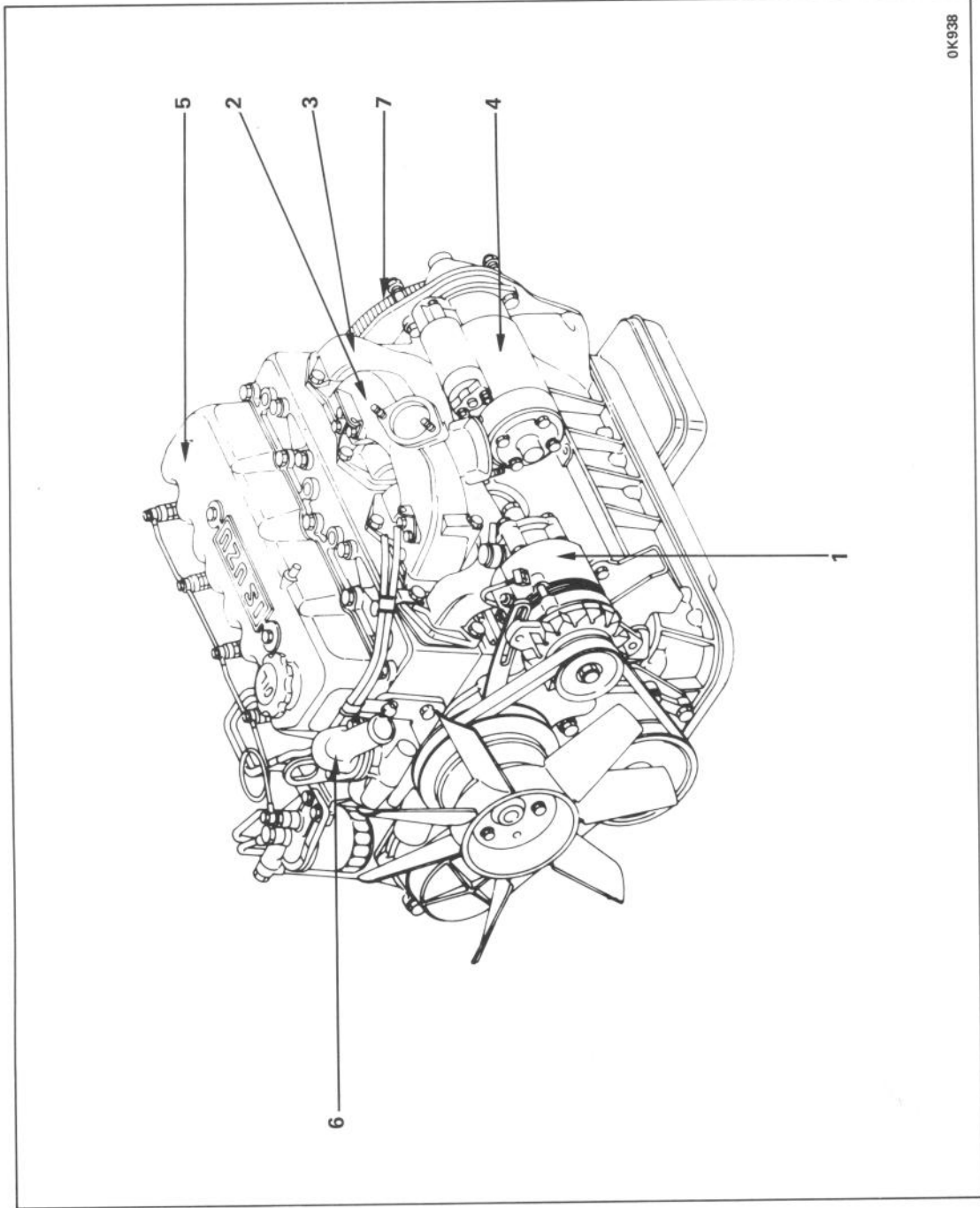


Disassembly steps

1. Cooling fan and spacer
2. Fan belt
3. Fan pulley
4. Leak off pipe
5. Injection pipe

6. Injection nozzle
7. Water hose
8. Oil filter assembly
9. Air breather hose
10. Water hose

EXTERNAL PARTS (Left hand side)



OK938

Disassembly steps

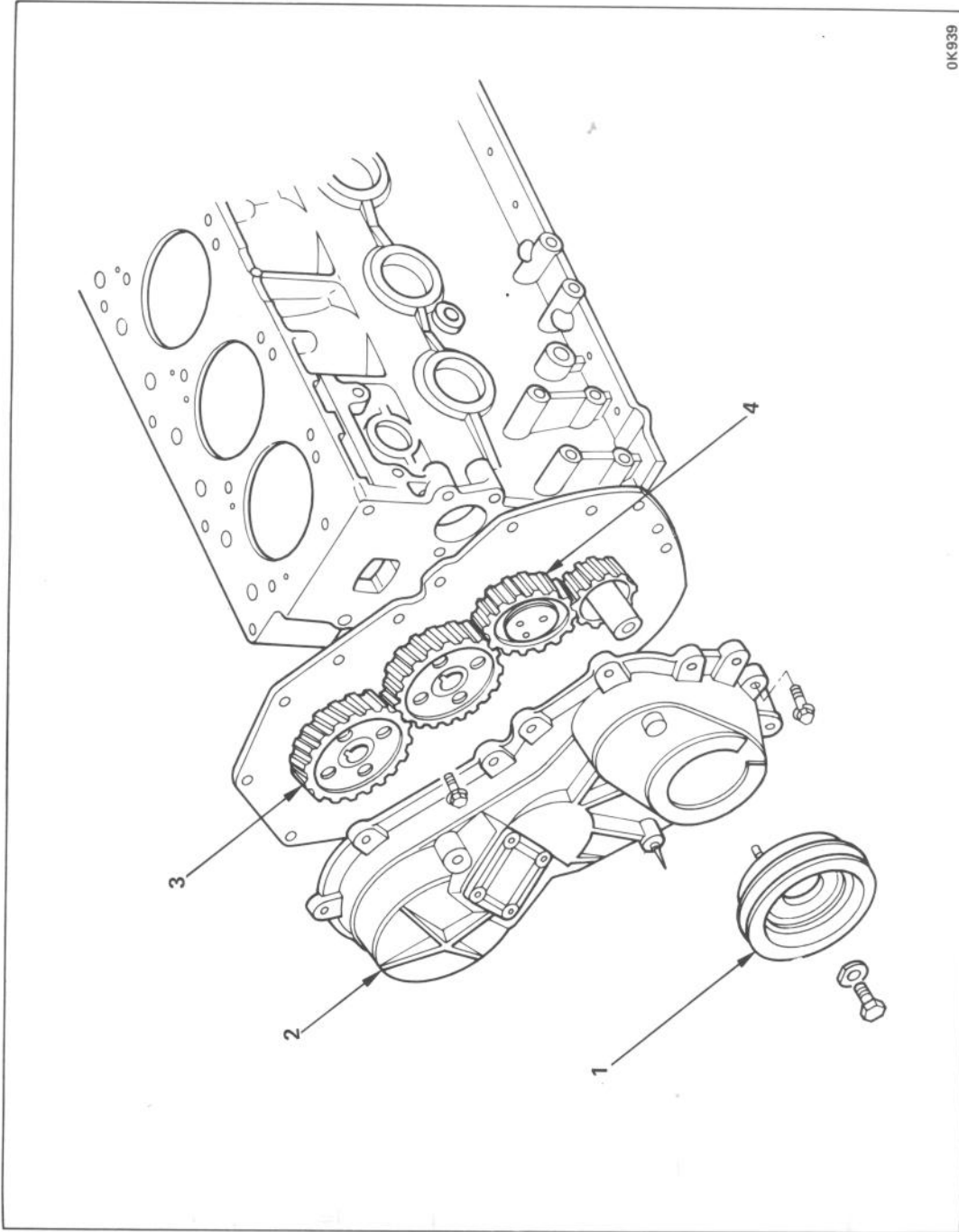
1. Generator assembly
2. Intake manifold
3. Exhaust manifold
4. Starter motor

5. Head cover
6. Thermostat housing
7. Flywheel

INTERNAL PARTS (Timing gear train)

MAJOR COMPONENTS

Gear drive type



OK939

Disassembly steps

1. Pulley
2. Timing gear case cover

- ▲ 3. Injection pump gear
- ▲ 4. Idler gear

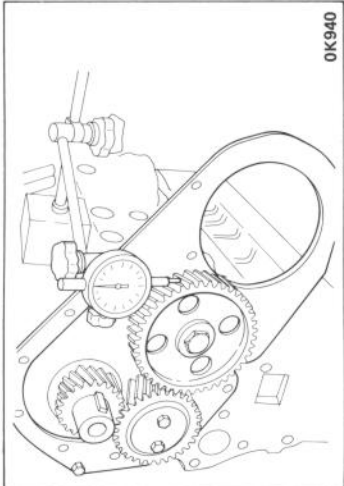


Important operations



3. Injection pump assembly

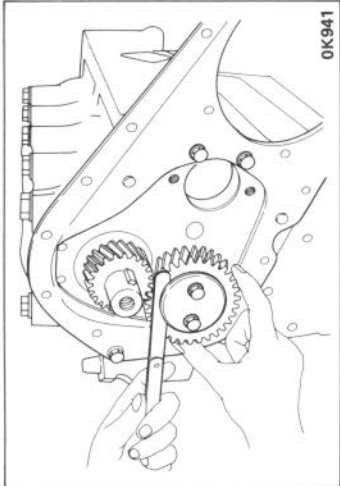
Inspect the following items before timing gear removal.
Backlash (crankshaft gear, idler gear, camshaft gear, injection pump gear).



Standard	Limit
0.10 — 0.17	0.3



4. Idler gear end play

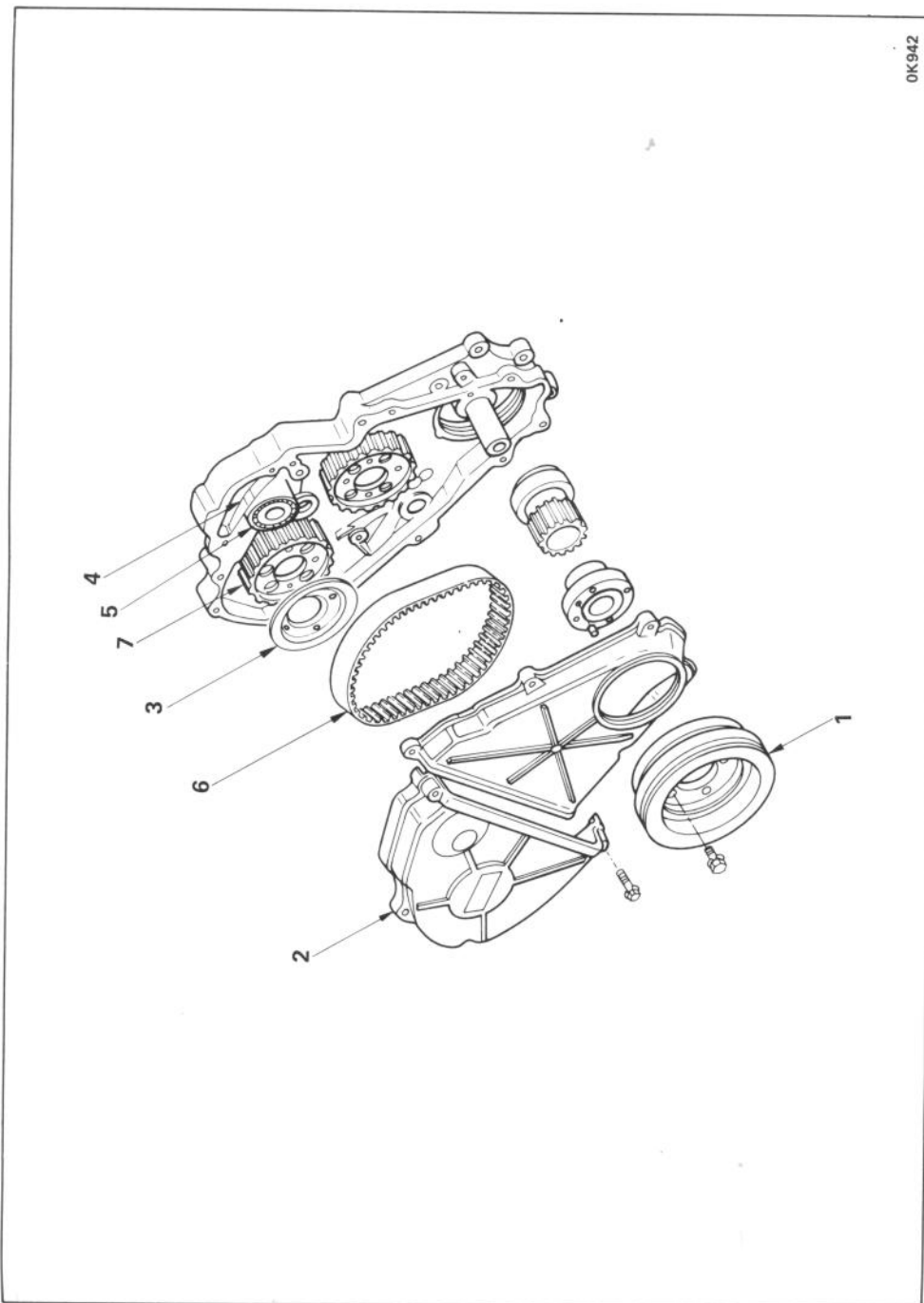


Standard	Limit
0.07	0.2

INTERNAL PARTS (Timing gear train)

MAJOR COMPONENTS

Belt drive type



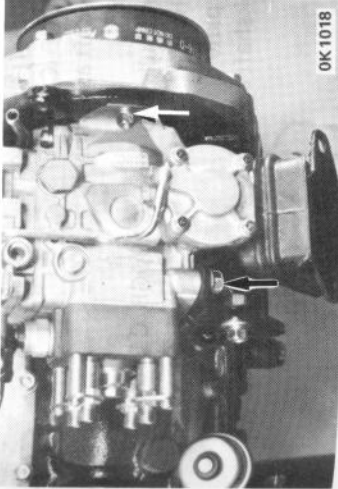
Disassembly steps

1. Pulley
2. Pulley housing cover
3. Injection pump timing pulley flange
4. Tension spring

5. Tension bearing and center
6. Timing belt
7. Injection pump gear



Important operation

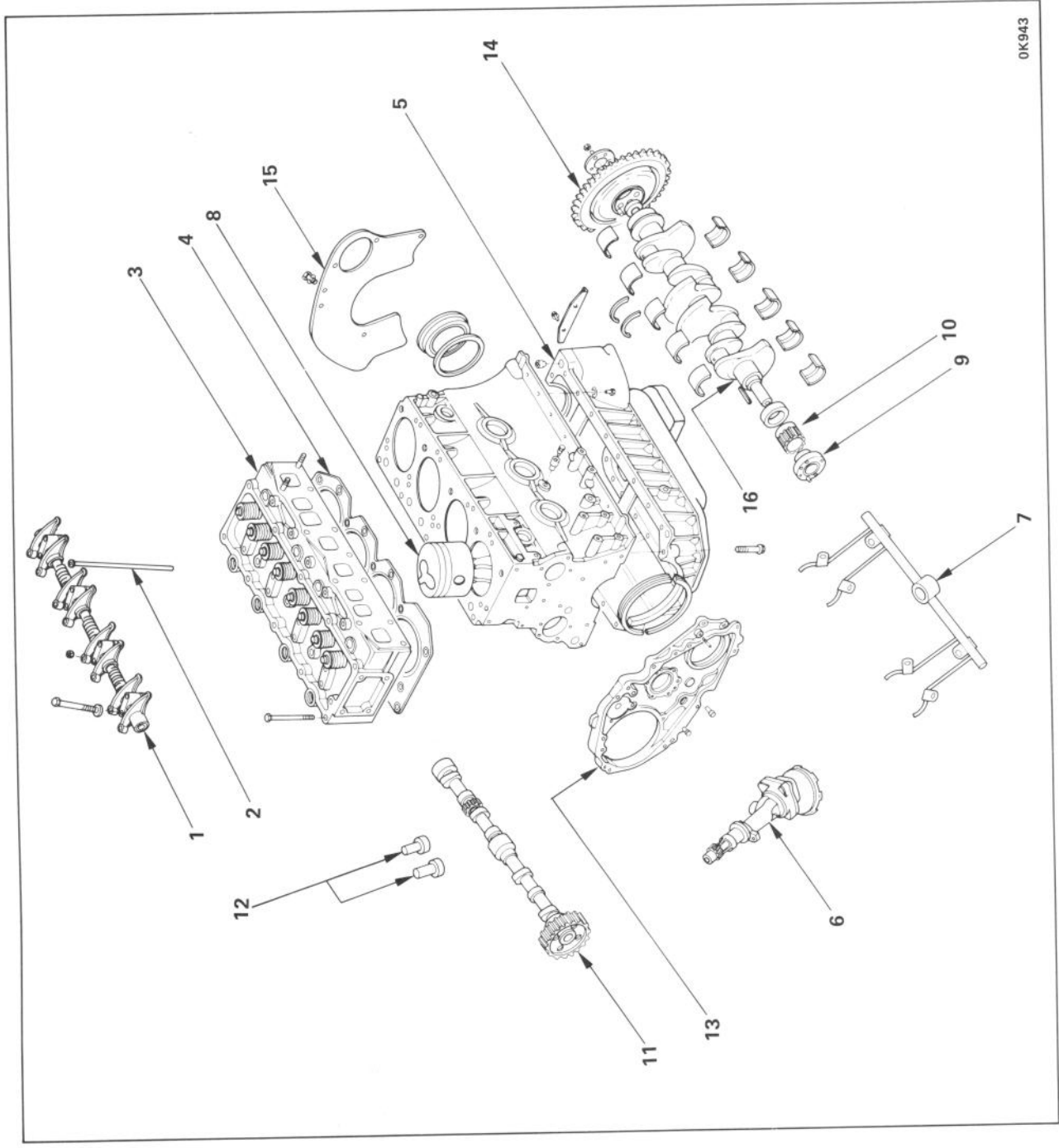


7. Injection pump gear

Remove the injection pump front bracket and rear bracket.

INTERNAL PARTS

MAJOR COMPONENTS



Disassembly steps

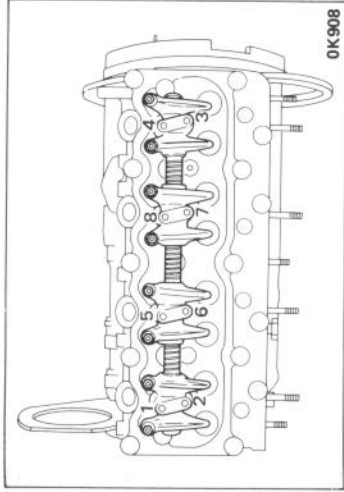
- | | |
|--|---|
| ▲ 1. Rocker arm shaft bracket and shaft | ▲ 10. Crankshaft timing pulley (C190GB, C190KE) |
| ▲ 2. Push-rod | ▲ 11. Camshaft assembly |
| ▲ 3. Cylinder head | 12. Tappet |
| 4. Cylinder head gasket | 13. Timing pulley housing (C190GB, C190KE) |
| 5. Crankcase | 14. Flywheel |
| 6. Oil pump | 15. Rear plate |
| 7. Oiling jet | ▲ 16. Crankshaft assembly |
| 8. Piston | |
| 9. Crankshaft pulley center (C190GB, C190KE) | |



Important operations

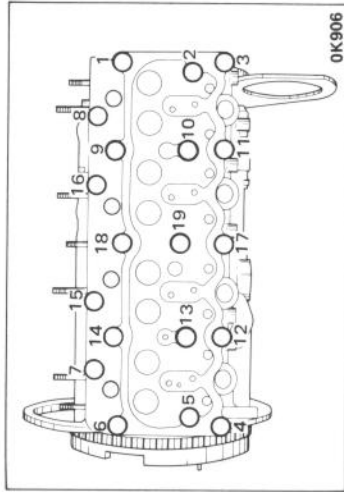
1. Rocker arm bracket and shaft

Loosen rocker arm shaft bracket bolts in numerical order.



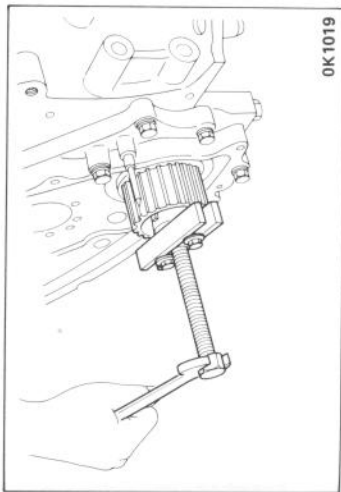
3. Cylinder head

Loosen cylinder head bolts in numerical order.



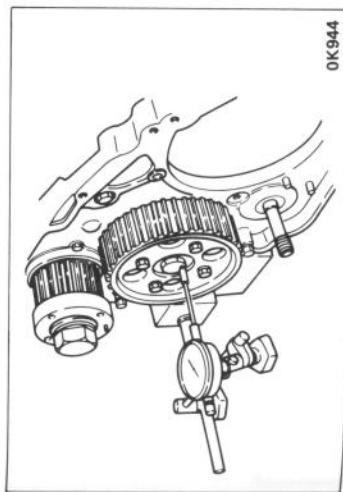
10. Crankshaft timing pulley (C190GB, C190KE)

Remover : 5-85210-016-0



11. Camshaft end play (C190GB, C190KE)

(mm)		
Standard	Limit	
0.08		0.2



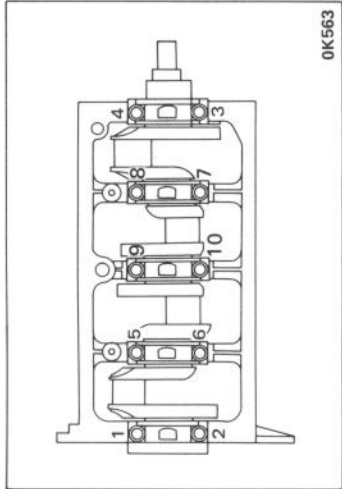
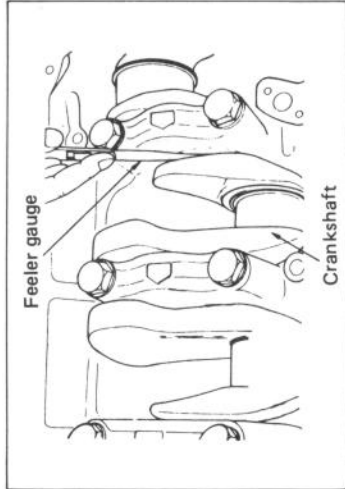


16. Crankshaft assembly

Check the crankshaft end play before disassembly.

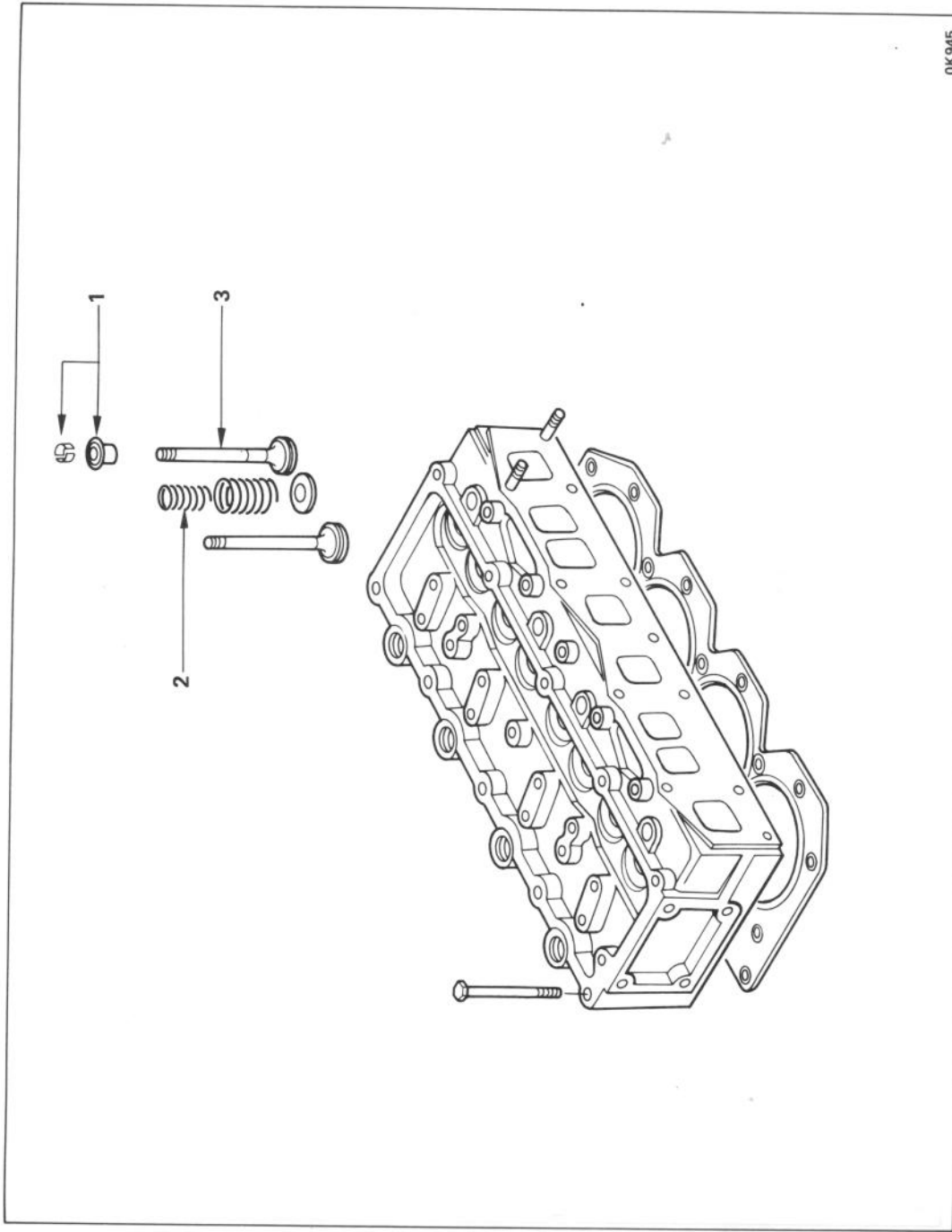
(mm)		
Standard		Limit
0.1		0.3

Crankshaft bearing cap bolts.
Loosen bearing cap bolts in numerical order.



MINOR COMPONENTS

CYLINDER HEAD



Disassembly steps

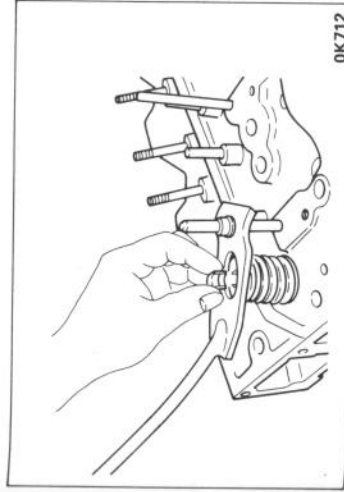
- ▲ 1. Spring seat and split key
- 2. Valve spring
- 3. Valve



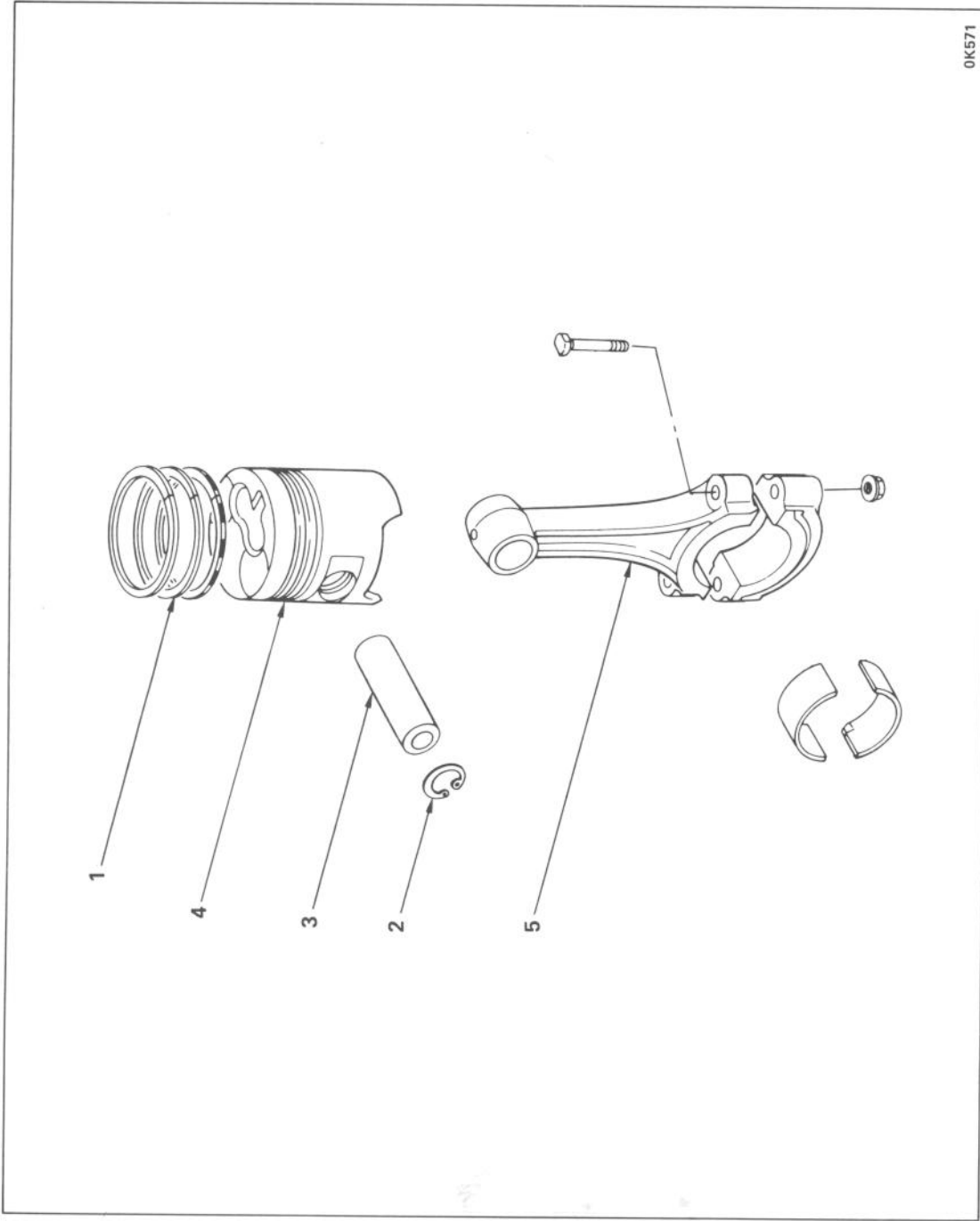
Important operation



- 1. Spring seat and split key
Compressor : 9-8523-1423-0



PISTON AND CONNECTING-ROD ASSEMBLY



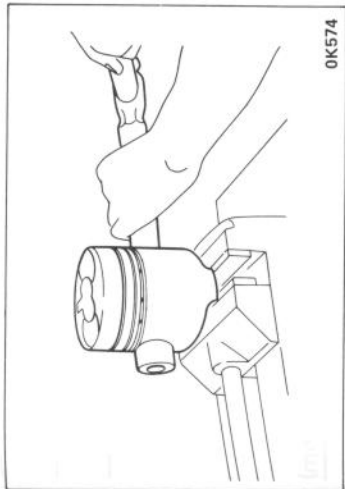
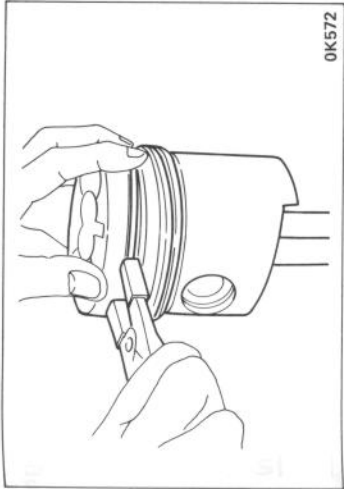
Disassembly steps

- ▲ 1. Piston ring
- 2. Snap ring
- ▲ 3. Piston pin
- 4. Piston
- 5. Connecting-rod

Important operations



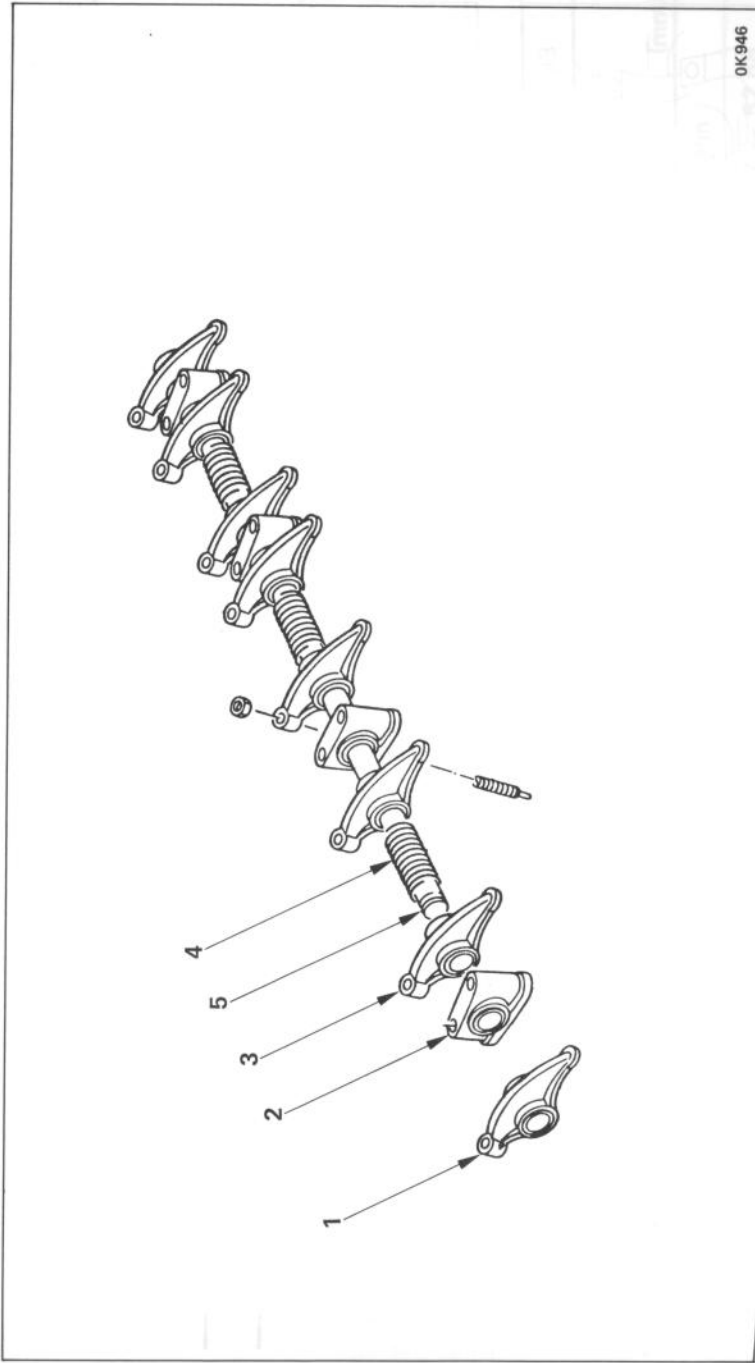
- 1. Piston ring Remover



- 3. Piston pin

Drive out the piston pin using a brass rod at normal temperature.

ROCKER ARM AND SHAFT ASSEMBLY



Disassembly steps

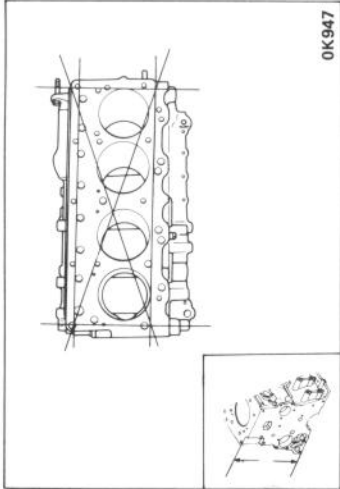
- 1. Rocker arm (A)
- 2. Rocker arm shaft bracket
- 3. Rocker arm (B)
- 4. Rocker arm shaft spring
- 5. Rocker arm shaft



INSPECTION AND REPAIR

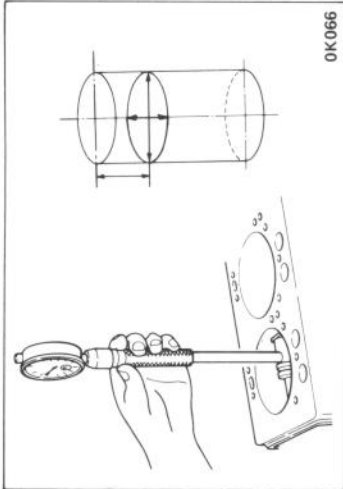
Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

CYLINDER BODY AND LINER



Cylinder body warpage

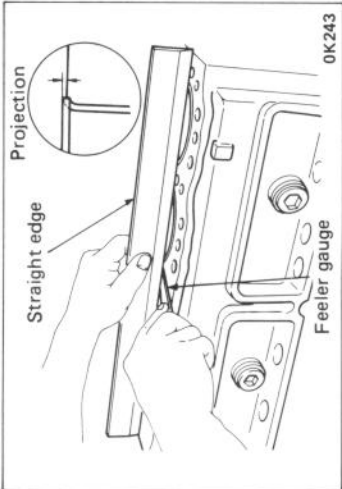
(mm)		
Overall length		Limit
		0.05
Thickness	C190	247.97 — 248.03
	C240	247.97 — 248.03
		247.72
		247.77



Cylinder liner bore diameter

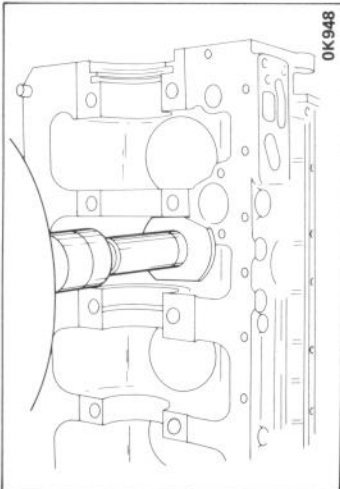
Measuring point : Approx. 15mm below upper face.

(mm)	
Standard	
Limit	
86.02 — 86.06	
86.10	



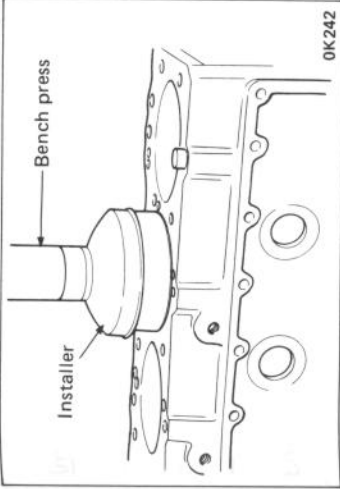
Amount of projection

Standard	(mm)
0 — 0.1	



Cylinder liner replacement

Remover : 9-8523-2552-0
Liner grip : 9-8522-1148-0

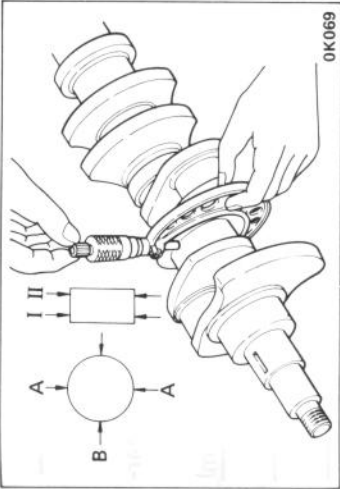


Installer : 9-8523-2551-0

Wipe clean the cylinder liner and cylinder body to remove oil, then install the cylinder liner into cylinder bore using a bench press.

The use of dry ice to cool the cylinder liner will invite contraction, facilitating smooth installation of the cylinder liner.

Tightness	(mm)
0 — 0.02	



Crankshaft journal and pin diameter
C190GB, C190KE, C190

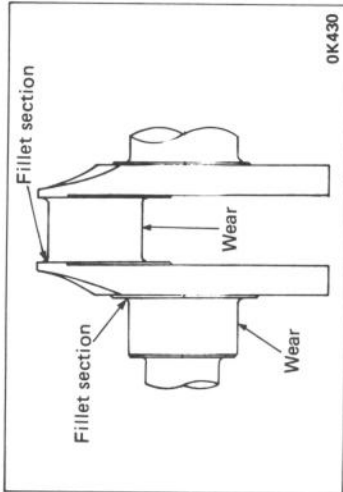
(mm)	
Standard	
Journal	
59.92 — 59.93	
Pin	
52.92 — 52.93	
C240	
(mm)	
Standard	
Journal	
69.92 — 69.93	
Pin	
52.92 — 52.93	

Undersize bearings are available in 4 different sizes which include 0.25, 0.5, 0.75 and 1.0 mm undersizes.

Crankshaft diameter when using undersize bearing
C190GB, C190KE, C190

(mm)	
Journal	
Pin	
U/S 0.25	
59.67 — 59.68	
52.67 — 52.68	
U/S 0.50	
59.42 — 59.43	
52.42 — 52.43	
U/S 0.75	
59.17 — 59.18	
52.17 — 52.18	
U/S 1.00	
58.92 — 58.93	
51.92 — 51.93	

(mm)	
Journal	
Pin	
U/S 0.25	
69.67 — 69.68	
52.67 — 52.68	
U/S 0.50	
69.42 — 69.43	
52.42 — 52.43	
U/S 0.75	
69.17 — 69.18	
52.17 — 52.18	
U/S 1.00	
68.92 — 68.93	
51.92 — 51.93	

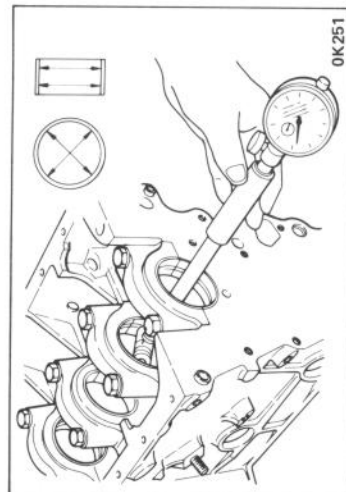


Uneven wear

	Standard	Limit
Journal	0.001	0.05
Pin	0.001	0.05

Curvature of the fillet section on the crankshaft journals and crankpins should be finished as shown below.

	Standard
Journal	3.3 — 3.7
Pin	3.3 — 3.7

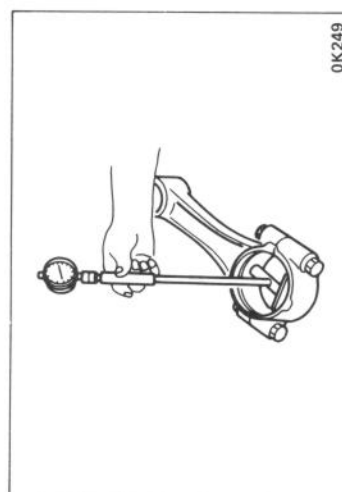


Clearance between crankshaft journal and connecting rod bearing

	Standard	Limit
C190GB, C190KE, C190	0.029 — 0.085	0.12
C240	0.018 — 0.065	0.12

Crankshaft bearing cap bolt.

Torque	(kg-m)	16 — 18
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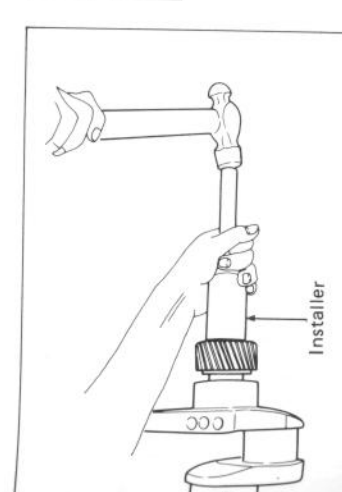
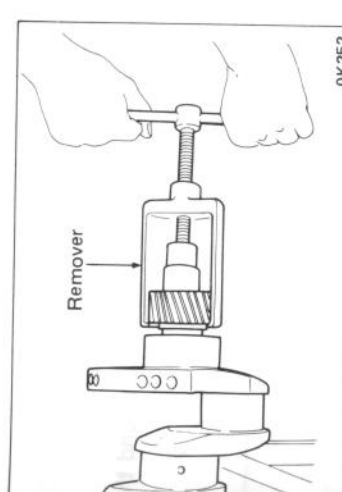
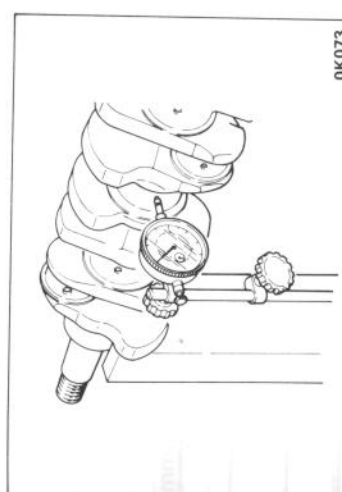
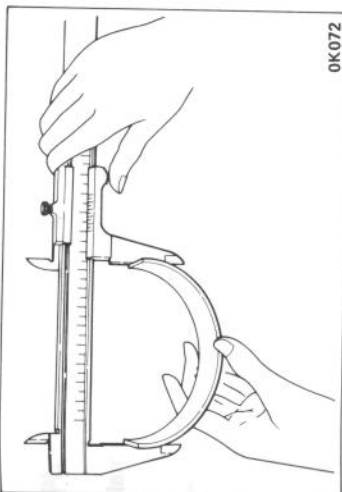
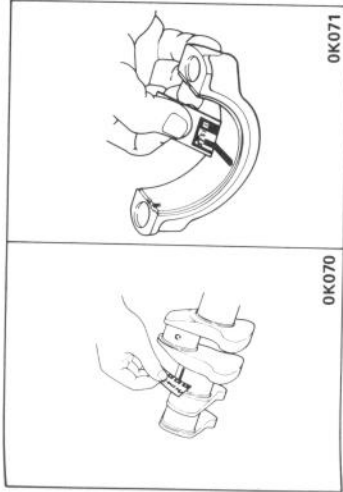


Clearance between crankpin and connecting-rod bearing

	Standard	Limit
C190GB, C190KE, C190	0.029 — 0.085	0.12
C240	0.018 — 0.065	0.12

Connecting-rod cap nut.

Torque	(kg-m)	8 — 9
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The clearance can also be measured using a plastigage.



Bearing spread

	Models	Limit
Crankshaft bearing	C190GB, C190KE, C190	64.5
	C240	74.5
Connecting-rod bearing	C190GB, C190KE, C190	56.5
	C240	56.5



Run-out

	Standard	Limit
	0.03	0.06

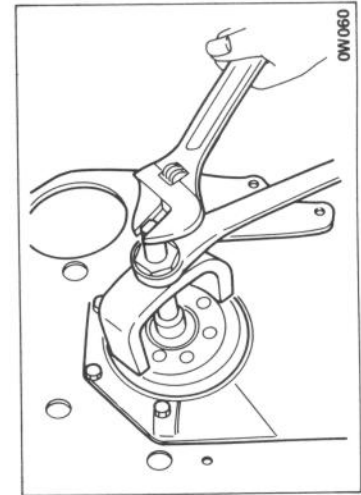
Crankshaft gear replacement (C190, C240)

Removal

Remover : 9-8521-0074-0

Installation

Installer : 9-8522-0021-0



Pilot bearing replacement
Remover : 9-8523-1812-0



FLYWHEEL

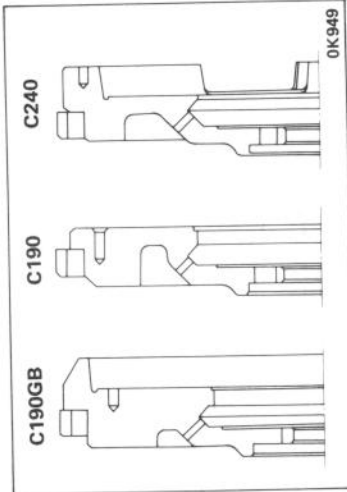


Inspect the following parts for wear, damage or other abnormal conditions.



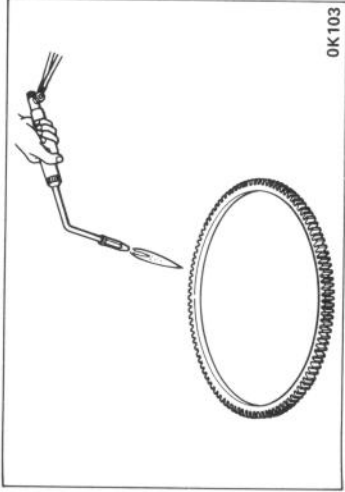
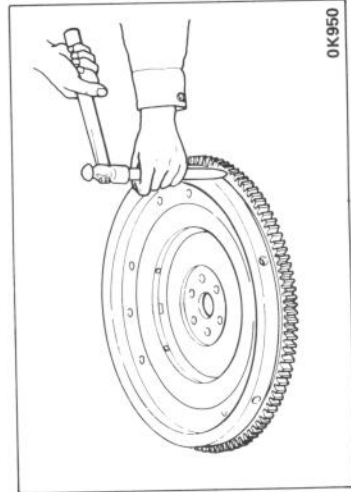
Depth and thickness

	Standard	Limit
C190GB, C190KE	17.9 — 18.1	19.0
C190	32.9 — 33.0	32.0
C240	17.9 — 18.1	19.0

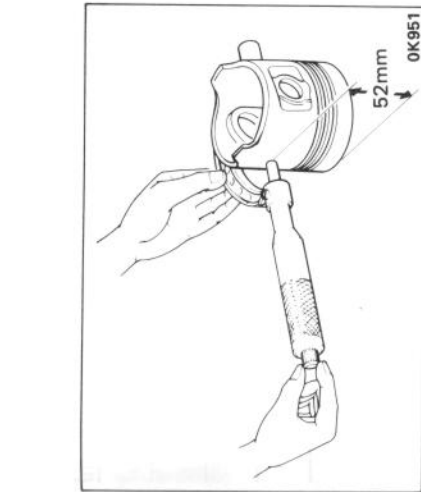


Ring gear replacement

Remove the ring gear from the flywheel by tapping around the side face of the gear with a brass bar.



PISTON



Piston clearance

Piston outside diameter

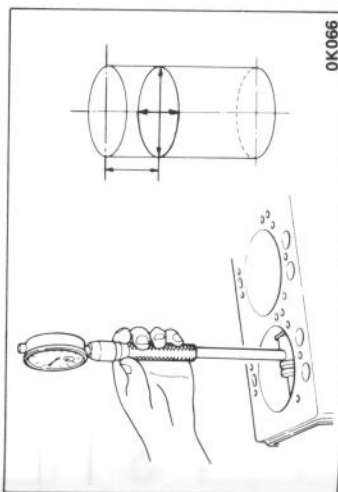
Take measurement in direction at a right angle to the piston pin hole.

Grading position : 52mm

The piston grade should be selected by referring to the following table, so that specified piston clearance can be obtained.

Piston outside diameter

Piston mark	Standard
A	85.888 — 85.907
C	85.908 — 85.927

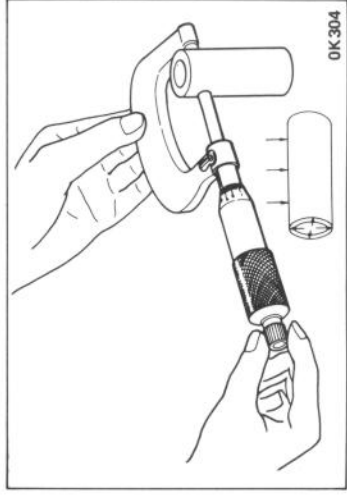


Cylinder liner inside diameter

	Standard
Cylinder liner inside diameter	86.02 — 86.06
Piston clearance	0.123 — 0.143



C190KE model engine is not equipped with cylinder liner therefore, Oversize pistons and piston rings are prepared for repair.

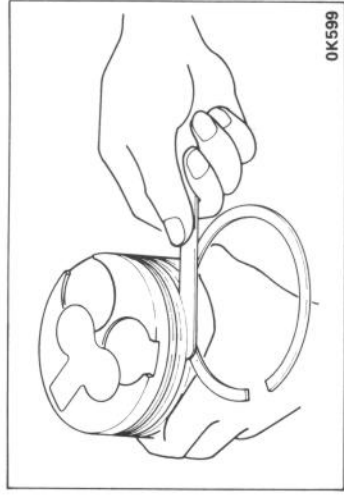


Piston pin outside diameter

Standard	Limit
27.0 — 26.995	26.96

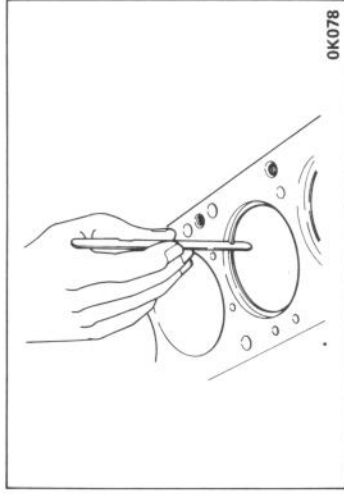
Fitting interference between piston pin and piston.

Standard	Limit
0 — 0.005	



Clearance between piston ring and ring groove

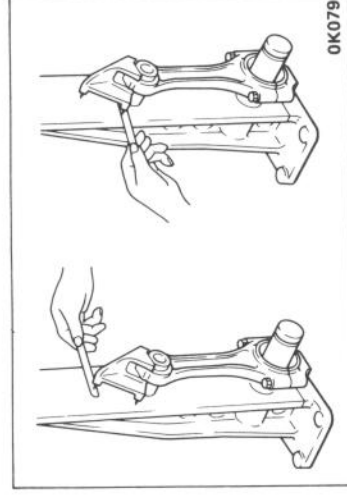
	Standard	Limit
1st compression ring	0.09 — 0.11	0.3
2nd compression ring	0.03 — 0.06	0.3
Oil ring	0.02 — 0.05	0.15



Piston ring gap

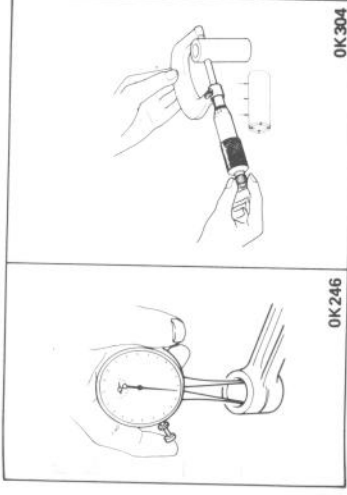
	Standard	Limit
1st compression ring	0.20 — 0.40	2.0
2nd compression ring	0.20 — 0.40	2.0
Oil ring	0.1 — 0.3	2.0

CONNECTING-ROD



Connecting-rod
Distortion and parallelism
(Per length of 100mm)

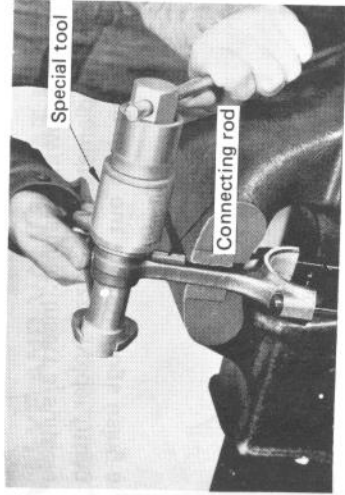
	Standard	Limit
Distortion	0.08	0.20
Parallelism	0.05	0.15



Bushing

Clearance between bushing and piston pin.

Standard	Limit
0.008 — 0.02	0.05



Bushing replacement



Removal



Remover : 9-8523-1369-0



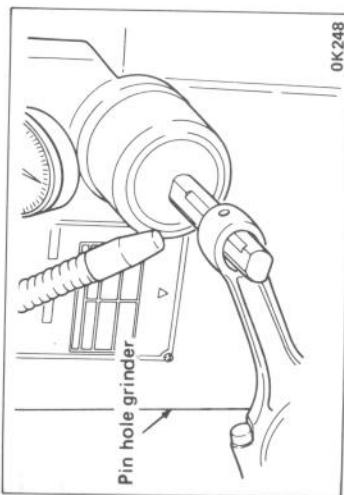
Installation



Installer : 9-8523-1369-0

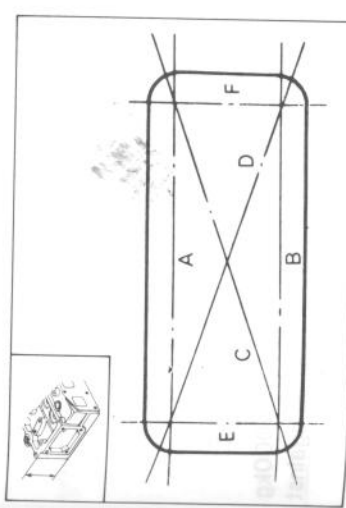


The inner face of the bushing must be finished with a remmer after installation of the bushing.



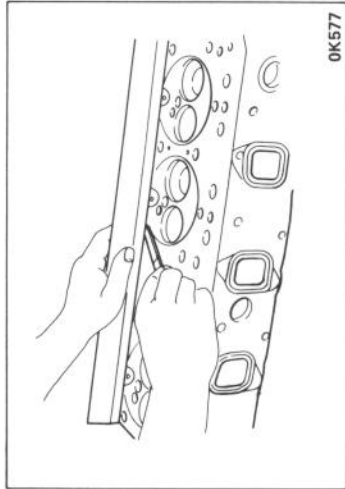
The inner face of the bushing must be finished with a remmer after installation of the bushing.

CYLINDER HEAD



Cylinder head warpage

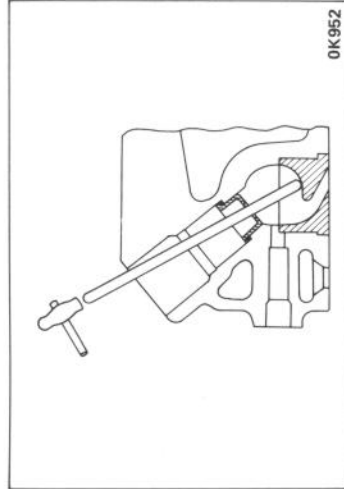
	Standard	Limit
Overall length	0.05	0.2
Thickness	91.95 — 92.05	91.75



Depression of hot plugs

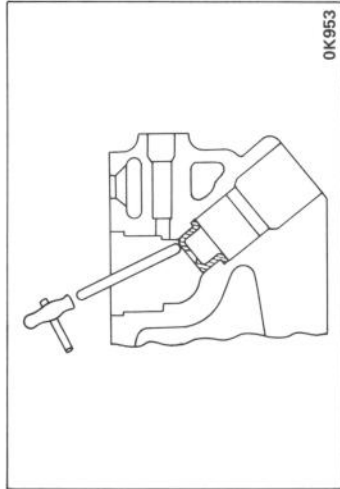
Check the amount of depression of hot plugs on No. 1 through No. 4 cylinders using a feeler gauge, with a straight edge held against the hot plug face.

Limit (mm)	0.02
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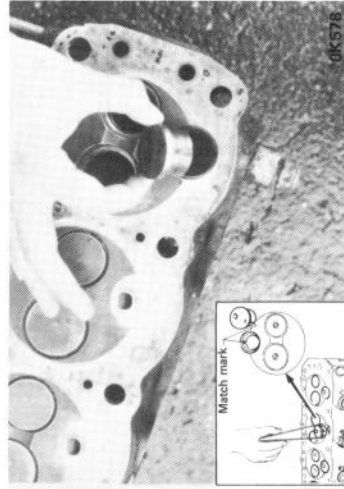
Hot plug replacement

Remove the hot plug in the following manner: Insert a suitable round bar sizing 3 to 5mm in diameter into nozzle holder fitting hole to touch the hot plug, then drive out the hot plugs using a hammer.



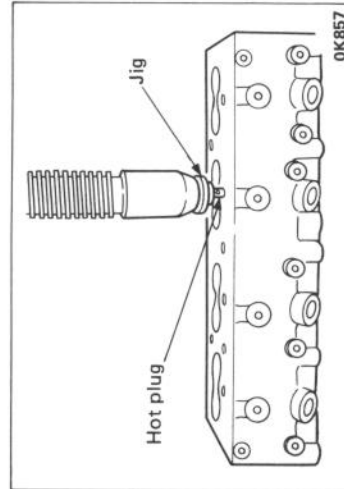
Heat shield replacement

Drive out the heat shield using a brass bar and hammer.

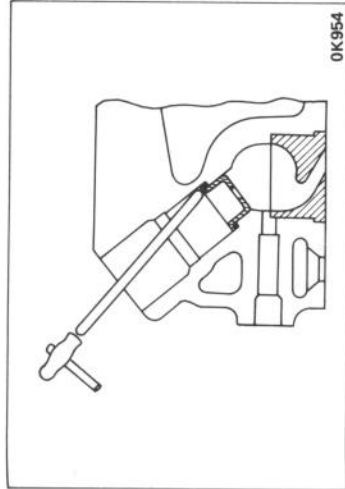


Installation of new hot plug

Install lock ball into groove in hot plug. Drive the hot plug into cylinder head by aligning lock ball in hot plug with groove in cylinder head.



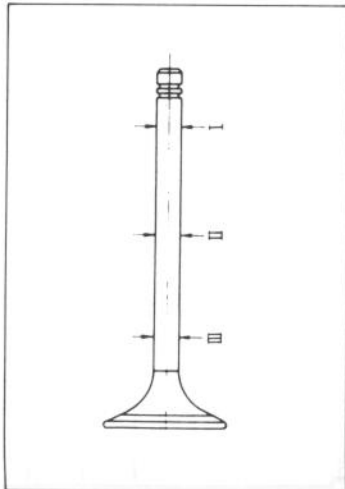
Press the hot plug into position by applying 4500 to 5000kg pressure using a bench press with a piece of metal fitted against the hot plug face for protection. After installation, grind the face of hot plug flush with the face of the cylinder head.



Installation of new heat shield

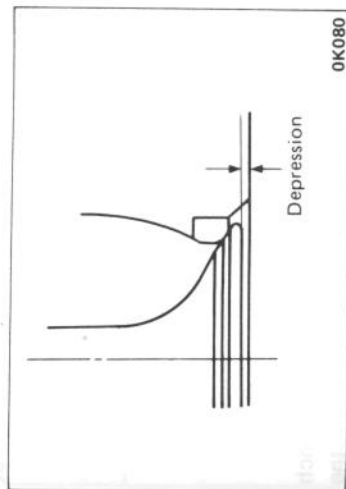
Install the heat shield with the flanged side up on the cylinder head by tapping on the flange lightly with a brass bar.

VALVE AND VALVE SEAT INSERT



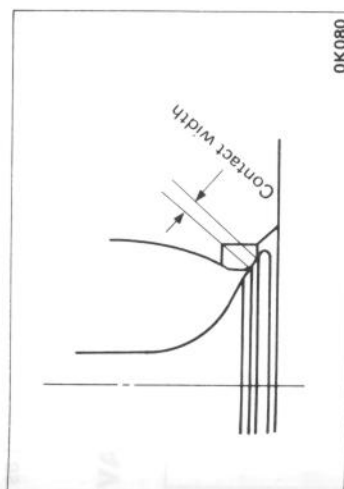
Valve stem diameter

	Standard	Limit
Intake valves	7.949 — 7.961	7.88
Exhaust valve	7.921 — 7.936	7.85



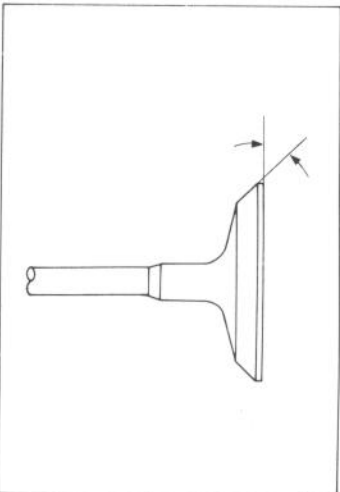
Depression

	Standard	Limit
Intake valves	0.7	2.5
Exhaust valves	0.7	2.5



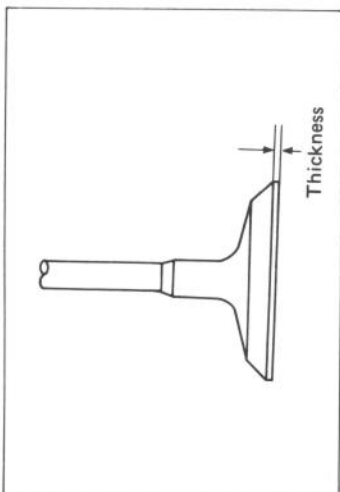
Contact width

	Standard	Limit
	1.2 — 1.5	3.6



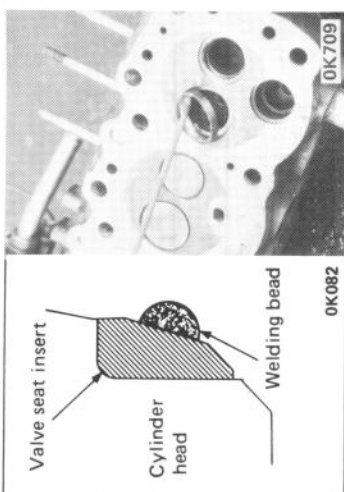
Valve seating angle

Valve seating angle	45°
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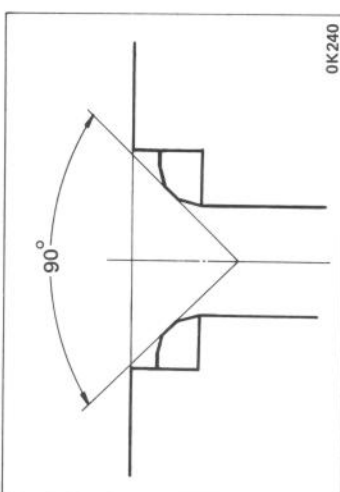
Valve seat thickness

	Standard	Limit
Intake valves	1.3	1.0
Exhaust valves	1.3	1.0



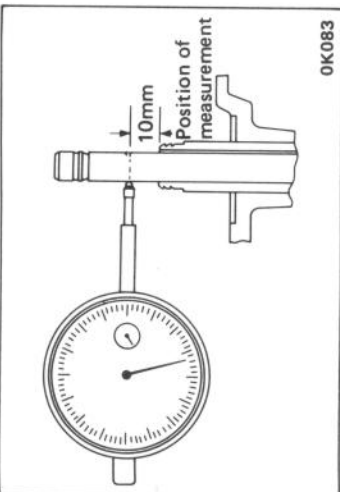
Valve seat insert replacement

Arc-weld excess metal around inner face of the valve seat insert and allow to cool off a few minutes, then pry off the valve seat insert with screw drivers.



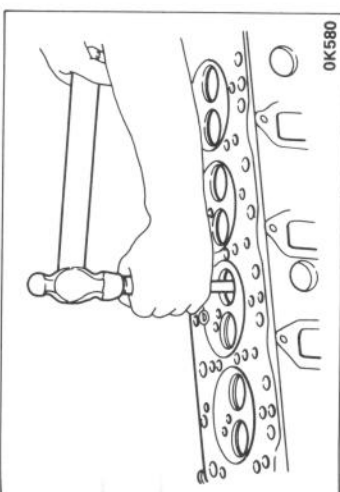
Press a new valve seat insert into the bore using a bench press. After installation of the valve seat insert, grind finish the seating face with a seat grinder carefully noting the seating angle, contact width and depression. Lap the valve and seat as the final step.

VALVE GUIDE



Clearance between valve stem and valve guide

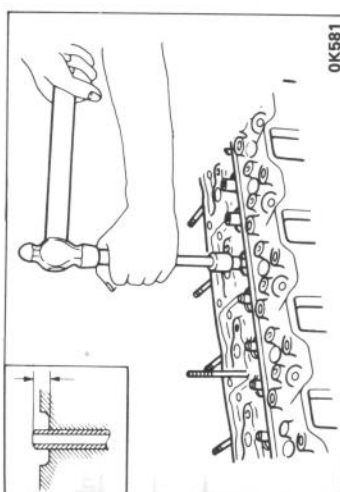
	Standard	Limit
Intake valves	0.039 — 0.068	0.20
Exhaust valves	0.064 — 0.093	0.25



Valve guide replacement

Removal

Remover : 5-85230-002-0



Installation

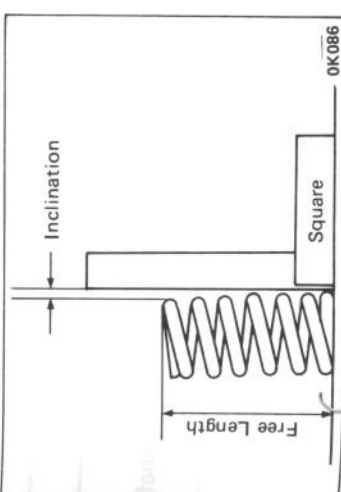
Apply engine oil to the outer circumference of the valve guide. Set the installer to the valve guide, then drive the guide into position from the upper face of the cylinder head using a hammer.

	Intake side	Exhaust side
Height of valve guide upper end from cylinder head upper face	13.0	14.0

Valve guide installer : 5-85230-002-0

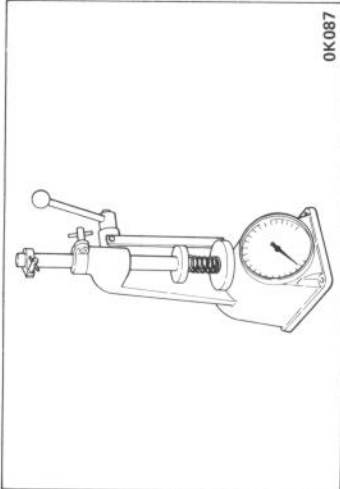
Discard used oil seals and install new ones.

VALVE SPRING



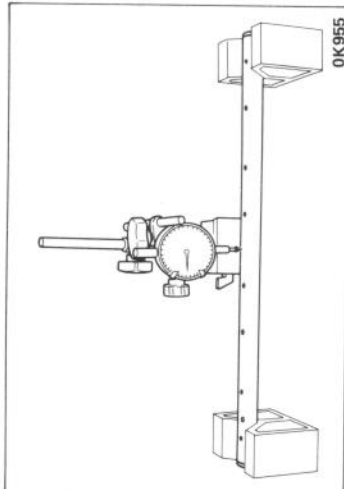
Free length and inclination

	Standard	Limit
Free length	Inner	47.9
	Outer	47.3
Inclination	Inner	1.0
	Outer	1.0

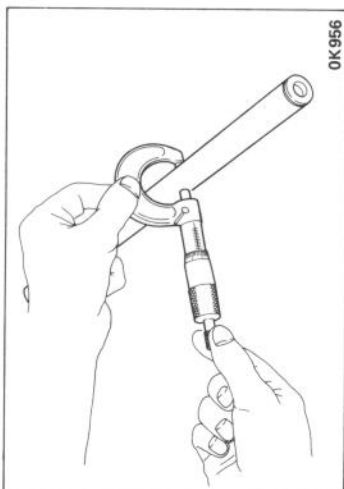


Spring tension (kg)			
	Set length	Standard	Limit
Inner	37.0mm	5.55 — 6.25	5.02
Outer	39.0mm	19.65 — 22.15	18.1

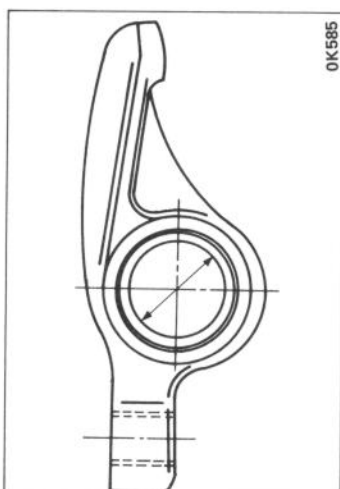
ROCKER ARM SHAFT AND ROCKER ARM ASSEMBLY



Run-out		
	Limit (mm)	
	0.6	

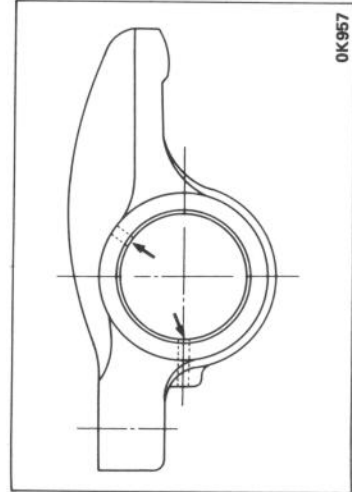


Rocker arm shaft diameter (mm)		
	Standard	Limit
	18.98 — 19.00	18.85



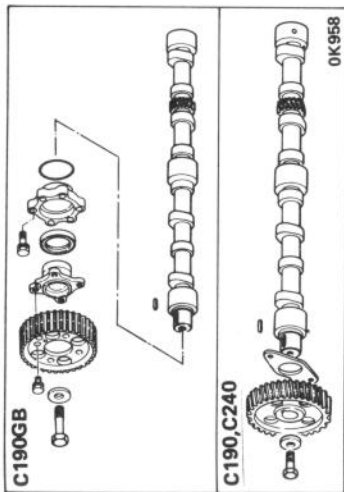
Rocker arm Clearance between rocker arm shaft and rocker arm. (mm)		
	Standard	Limit
	0 — 0.04	0.2

If the amount of wear is beyond the limit, replace either the shaft or rocker arms depending on the condition of wear.

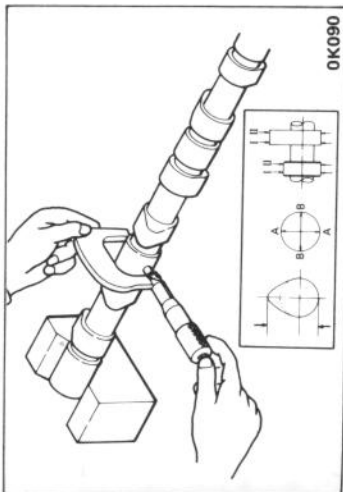


It is necessary to drill an oil port in the new rocker arm bushing as it is not provided with oil port.

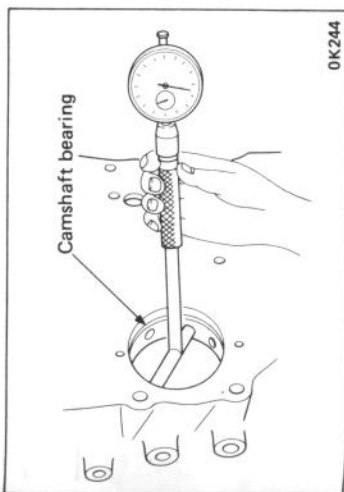
CAMSHAFT ASSEMBLY



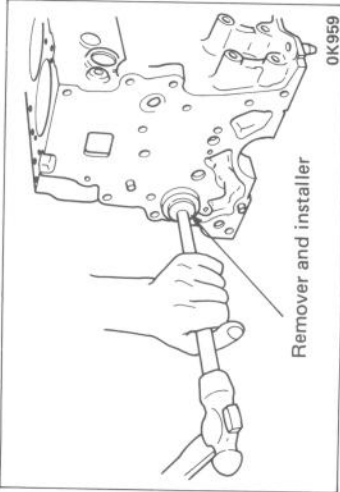
Difference between parts for models C190GB, C190 and C240.



Camshaft diameter and height of cam lobe. (mm)		
	Standard	Limit
Journal diameter	47.94 — 47.97	47.6
Height of cam lobe	40.57	40.2



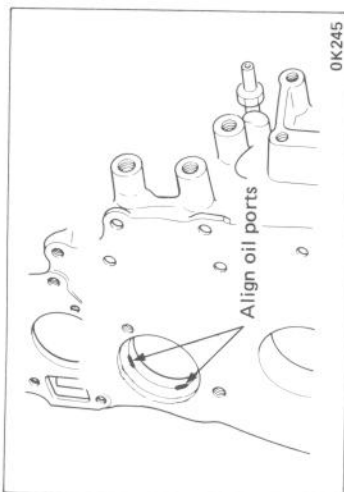
Clearance between camshaft and bearing (mm)		
	Standard	Limit
	0.05	0.12



Cam bearing replacement

Removal

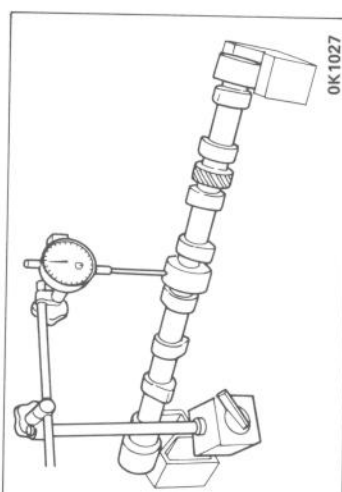
Remover and installer : 9-8523-1737-0 or
9-8523-1360-0



Installation

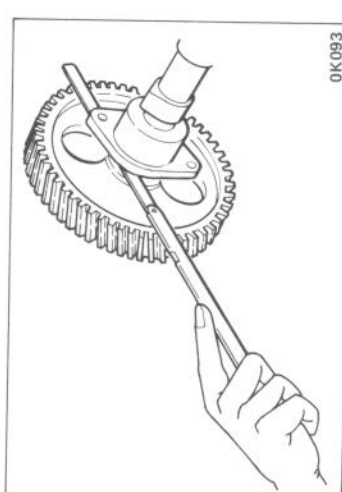
The oil port in the cylinder body must be aligned with that in the camshaft bearing.

Remover and installer : 9-8523-1737-0 or
9-8523-1360-0



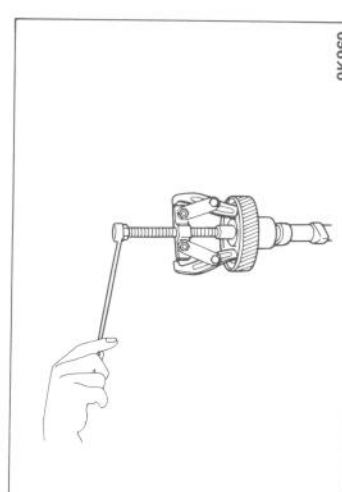
Run out

Standard	Limit
0.05	0.1



End play (C190, C240 only)

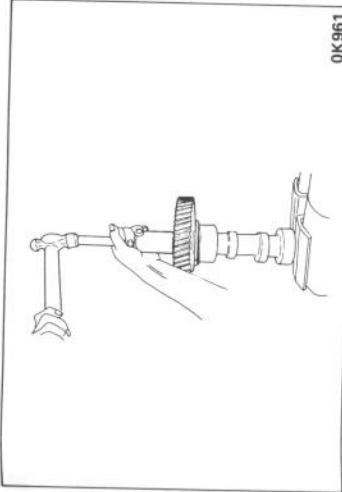
Standard	Limit
0.05 — 0.11	0.2



Camshaft gear replacement (C190, C240 only)

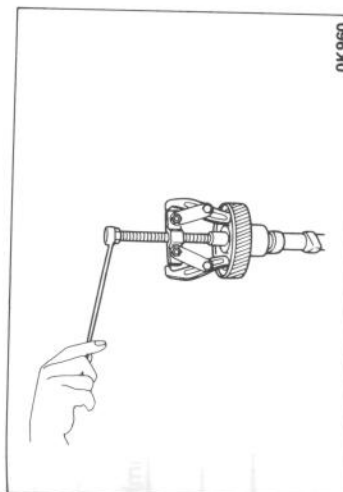
Removal

Remover : 5-85210-002-0



Installation

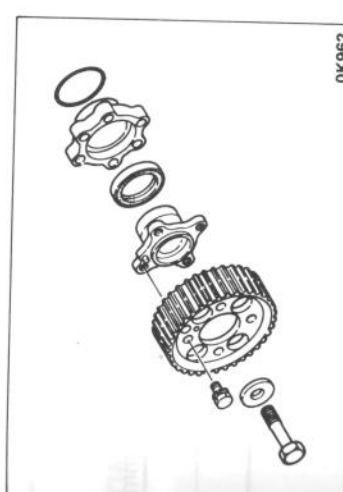
Drive the gear to the shaft aligning the key groove on the gear with the key on the shaft.



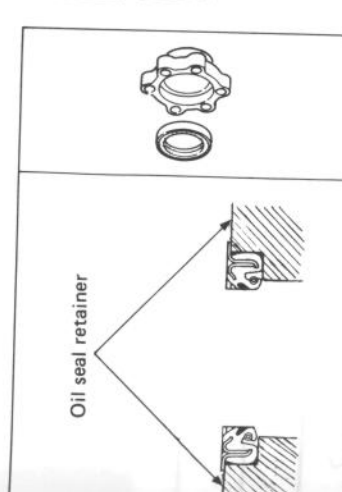
C190GB only

Removal

Remover : 5-85210-002-0



Inspect the following parts for wear, damage or other abnormal conditions



Oil seal replacement

Remover

Drive out the oil seal using a brass bar against the side with boss.

Installation

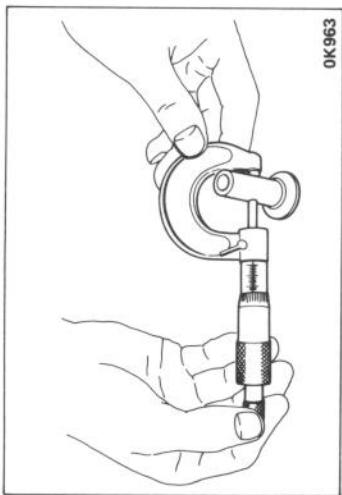
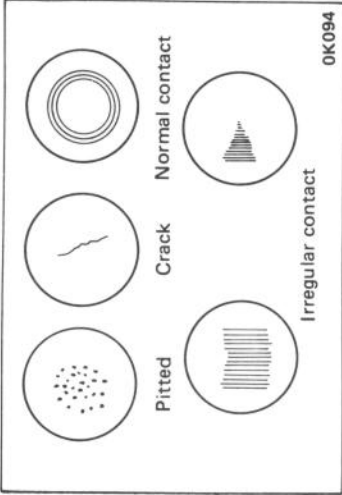
Install the oil seal flush with the retainer face.



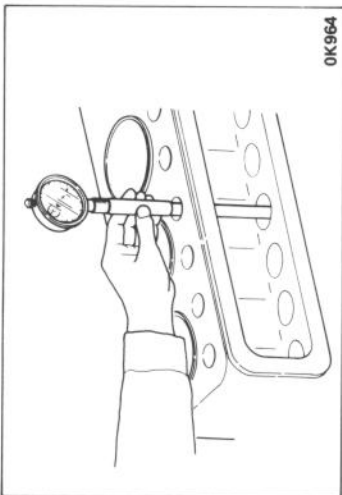
TAPPET



Inspect tappet for wear, damage or other abnormal condition.

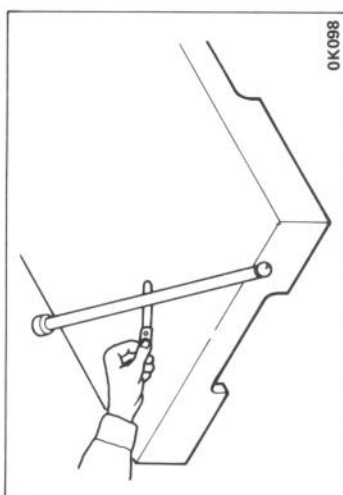


Diameter (mm)	
Standard	Limit
12.98 — 12.99	12.95



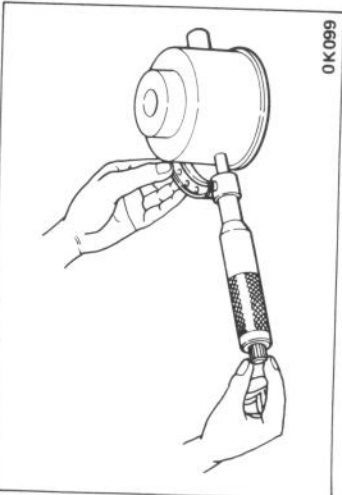
Clearance between tappet and cylinder body (mm)	
Standard	Limit
0.03	0.1

PUSH-ROD

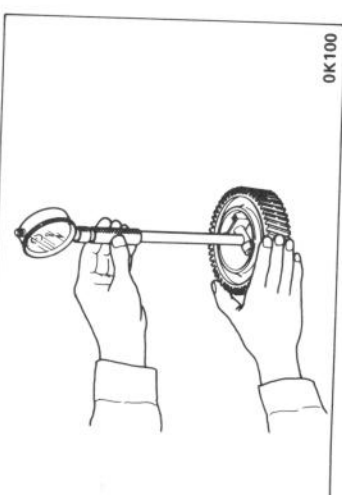


Run-out (mm)	
Limit	0.3

IDLER GEAR AND SPINDLE (C190, C240 only)

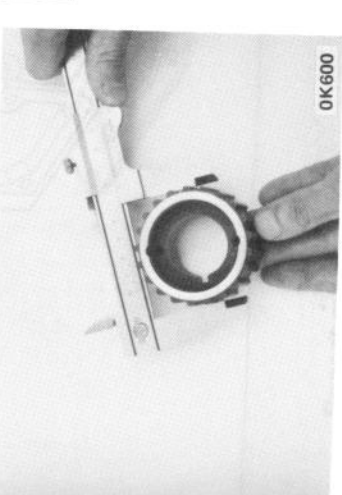


Spindle diameter (mm)	
Standard	Limit
44.945 — 44.975	44.845

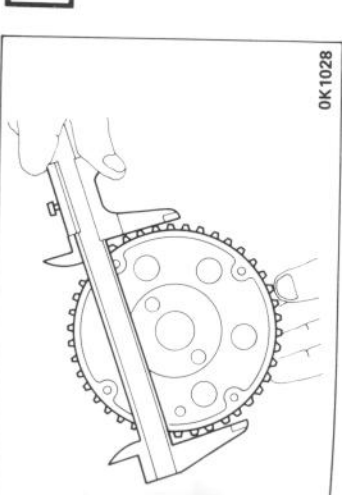


Clearance between spindle and idler gear (mm)	
Standard	Limit
0.025 — 0.085	0.2

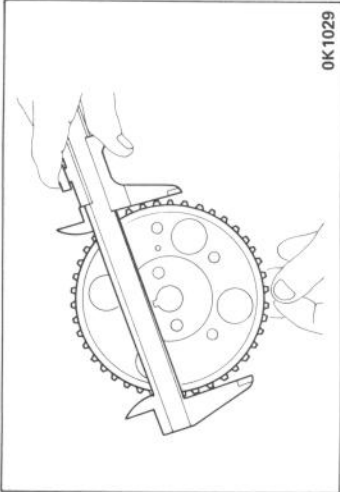
TIMING PULLEY (C190GB only)



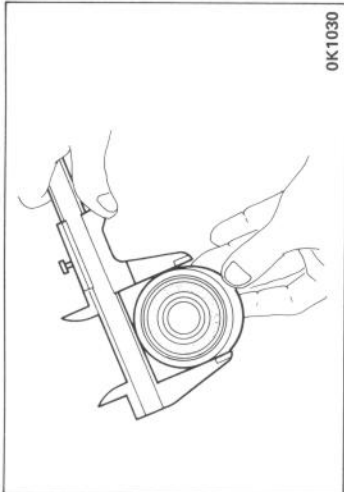
Crankshaft timing pulley outside diameter (mm)	
Standard	Limit
65.33 — 65.43	65.230



Camshaft pulley outside diameter (mm)	
Standard	Limit
132.032 — 132.152	131.932



Injection pump pulley outside diameter (mm)	
Standard	Limit
132.032 — 132.152	131.932

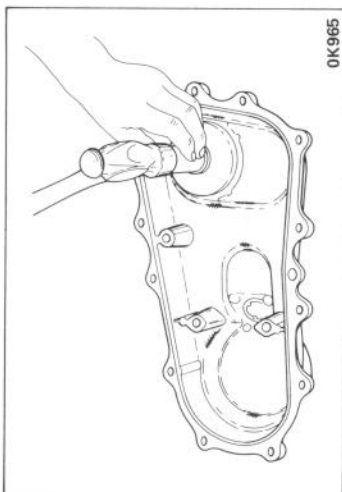


Tension bearing outside diameter (mm)	
Standard	Limit
61.8 — 62.0	61.6

Timing gear case cover oil seal replacement (C190, C240)

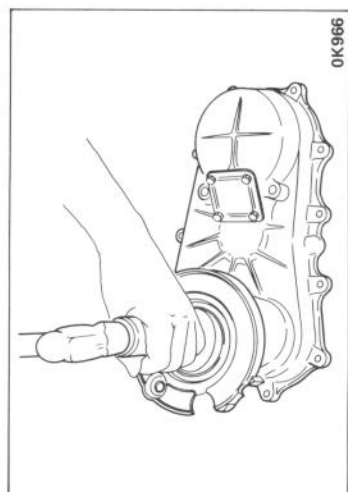


Removal



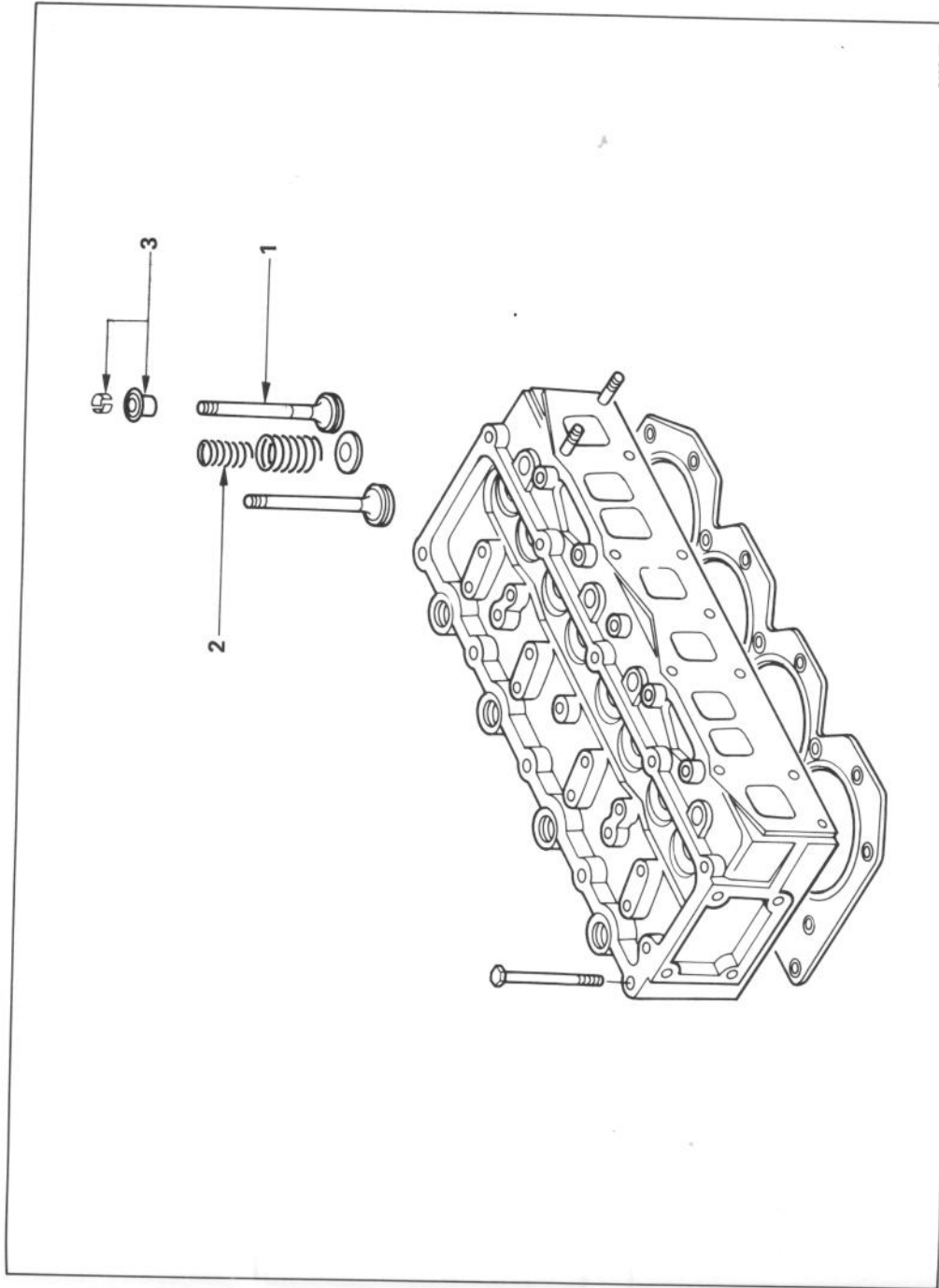
Installation

Installer : 5-85220-013-0



REASSEMBLY

MINOR COMPONENTS
CYLINDER HEAD



Reassembly steps

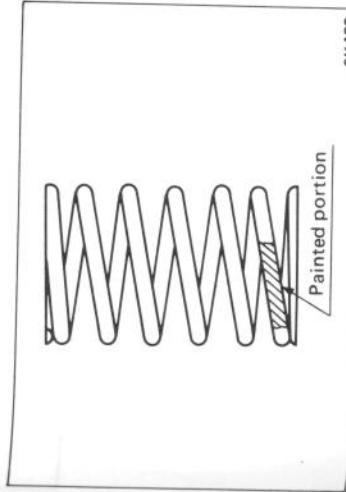
- 1. Valve
- ▲ 2. Valve spring
- ▲ 3. Spring seat and split key

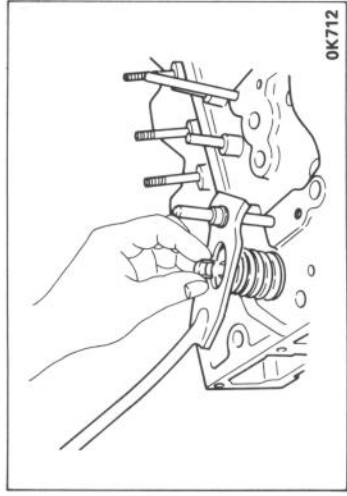


Important operations

2. Valve spring

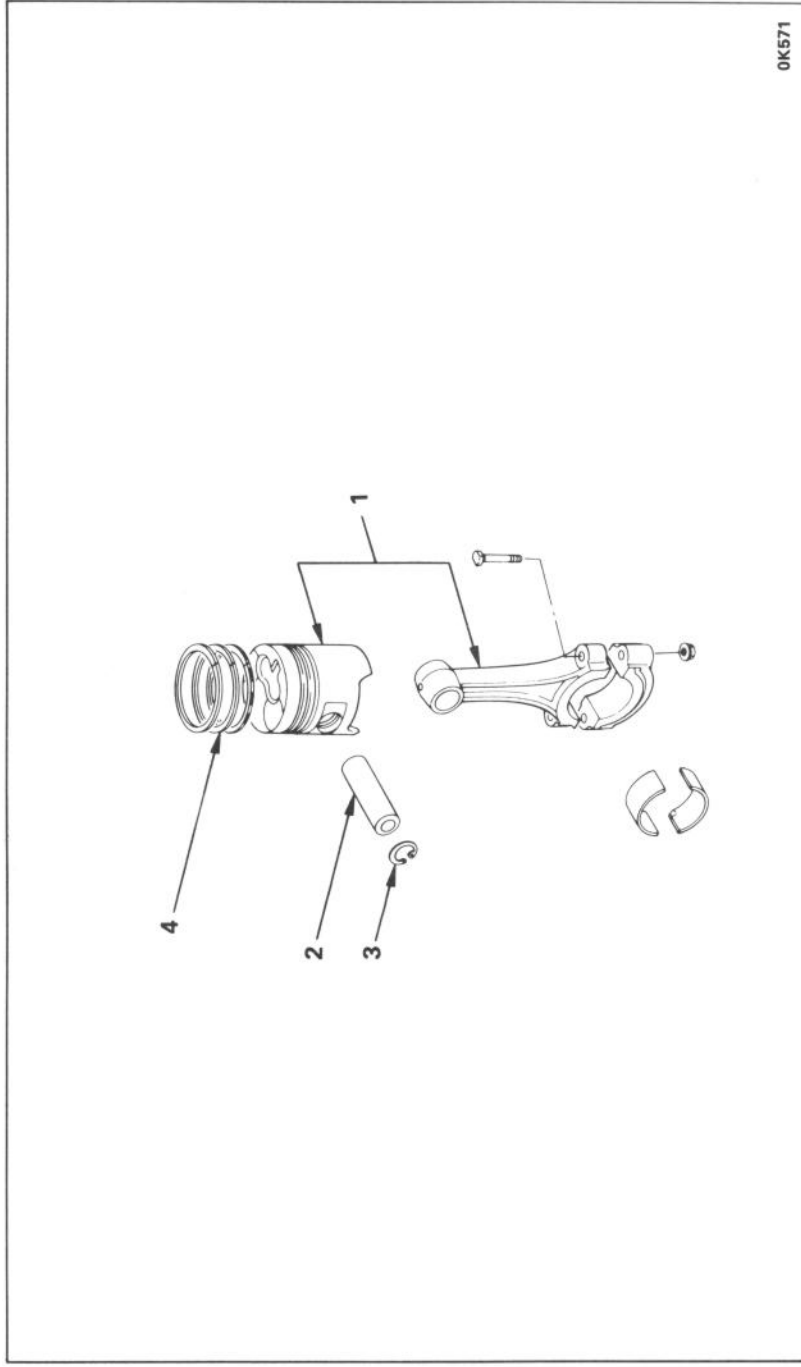
Install the valve springs with the painted end down.





-  3. Spring seat and split key
Compressor : 9-8523-1423-0

PISTON AND CONNECTING-ROD ASSEMBLY



Reassembly steps

- ▲ 1. Piston and connecting-rod
- ▲ 2. Piston pin
- ▲ 3. Snap ring
- ▲ 4. Piston ring

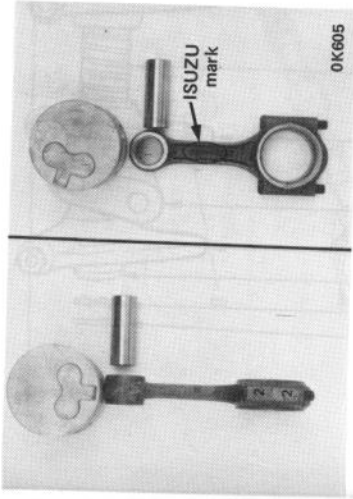


Important operations

1. Piston and connecting-rod

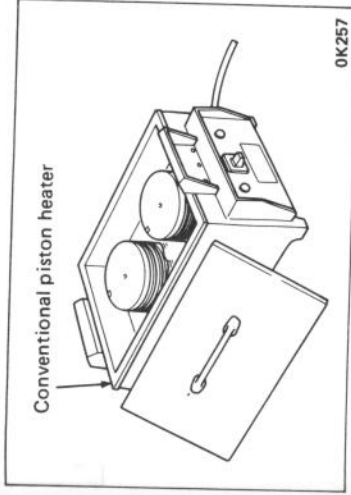
Install the piston on the connecting-rod, so that combustion chamber on piston head is on the same side with the cylinder number mark side (side with bearing stopper) of the connecting-rod big-end.

Isuzu mark on the connecting-rod should be on the same side of the front mark on the piston head.



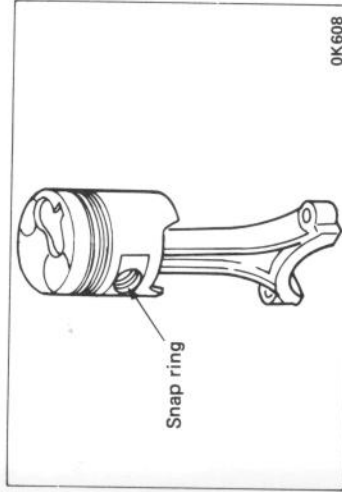
2. Piston pin

Install the piston pin after heating the piston to about 100°C.



3. Snap ring

Install the snap ring into the piston using snap ring pliers, then check to make certain the snap ring is fitted properly into the groove.

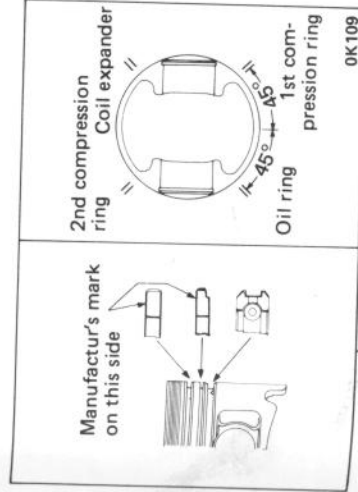


4. Piston ring

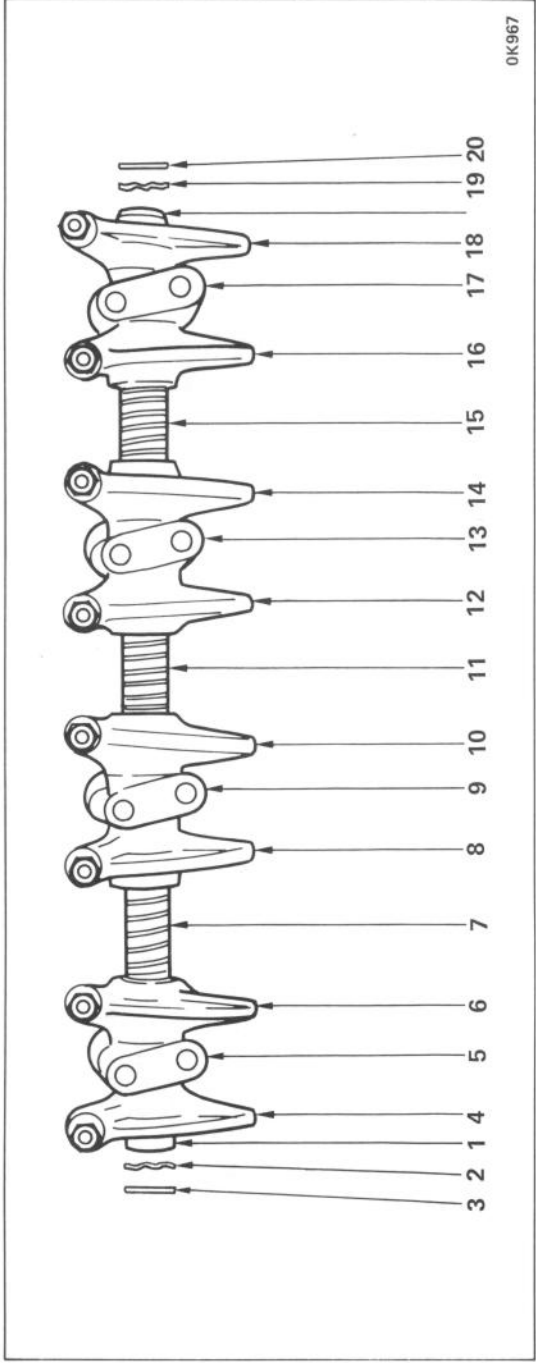
Installer : 1-85221-025-0

Install the 1st and 2nd compression rings with manufacturer's mark turned up. Oil ring can be installed on the piston with either side up.

Piston ring gaps should be positioned as shown in the figure.



ROCKER ARM AND SHAFT ASSEMBLY



Reassembly steps

1. Rocker arm shaft
2. Waving washer
3. Snap ring
- ▲ 4. Rocker arm (A)
5. Rocker arm shaft bracket
- ▲ 6. Rocker arm (D)
7. Spring
- ▲ 8. Rocker arm (C)
9. Rocker arm shaft bracket
- ▲ 10. Rocker arm (D)

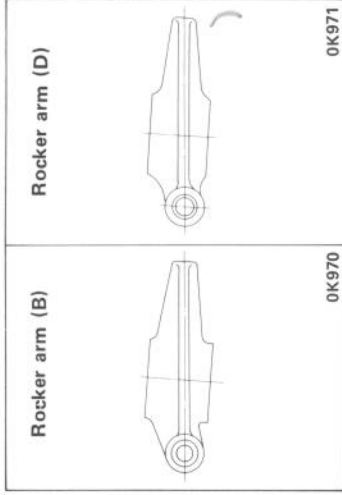
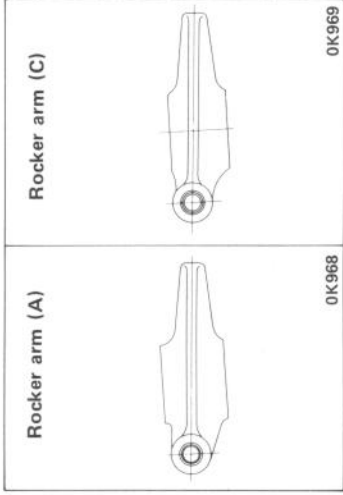
11. Spring
- ▲ 12. Rocker arm (C)
13. Rocker arm shaft bracket
- ▲ 14. Rocker arm (D)
15. Spring
- ▲ 16. Rocker arm (C)
17. Rocker arm shaft bracket
- ▲ 18. Rocker arm (B)
19. Waving washer
20. Snap ring



Important operations

4. Rocker arm (A)
8. 12. 16. Rocker arm (C)

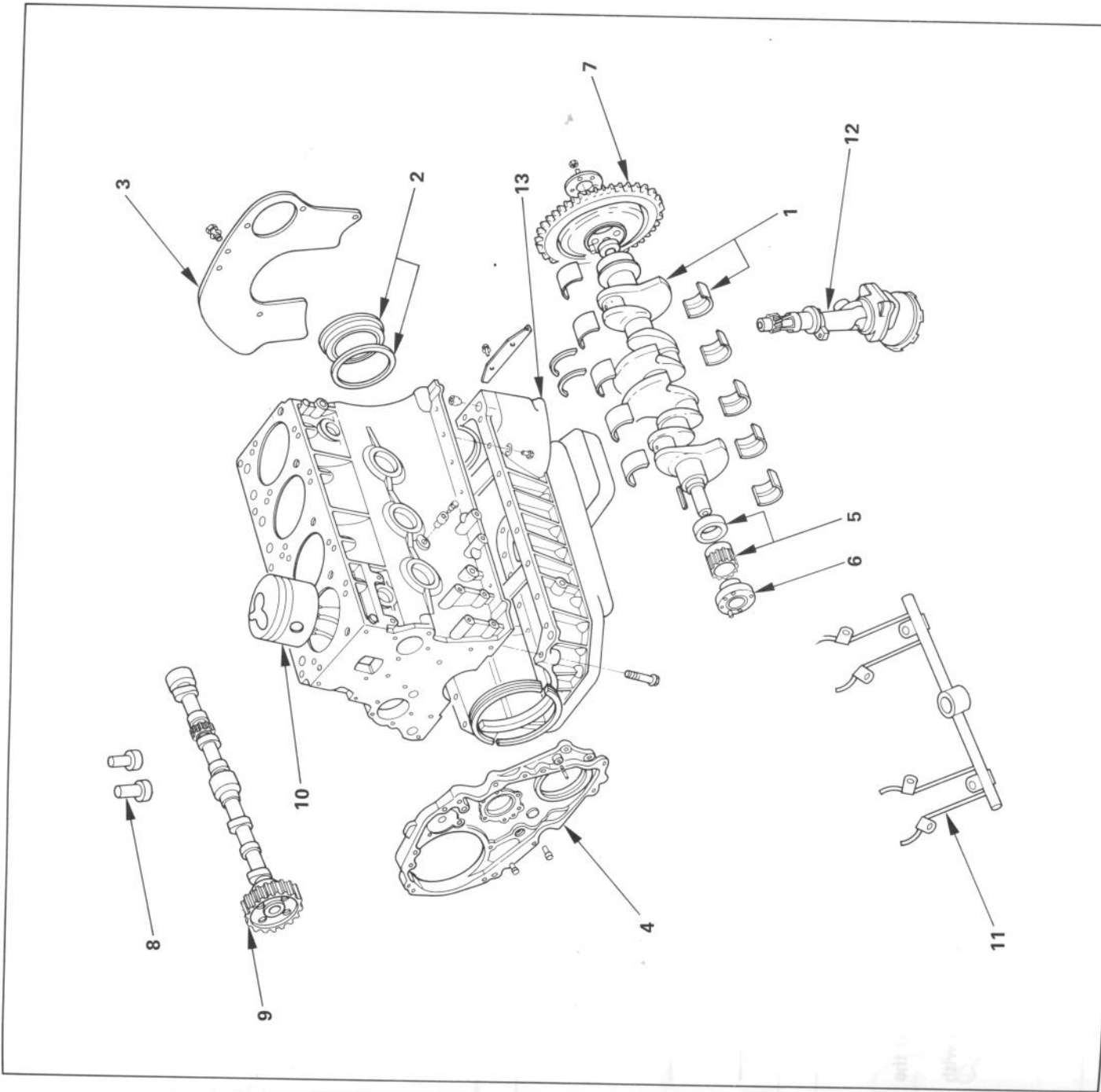
Difference between rocker arm A and C.



18. Rocker arm (B)
 6. 10. 14. Rocker arm (D)
- Difference between rocker arm B and D.

INTERNAL PARTS I

MAJOR COMPONENT



Reassembly steps

- ▲ 1. Crankshaft and bearing
- ▲ 2. Rear oil seal
3. Rear plate
4. Timing pulley housing
- ▲ 5. Crankshaft timing pulley
- ▲ 6. Crankshaft pulley center (C190GB only)

- ▲ 7. Flywheel
8. Tappet
9. Camshaft assembly
- ▲ 10. Piston and connecting-rod
- ▲ 11. Oiling jet
12. Oil pump
- ▲ 13. Crankcase and oil pan



Important operation

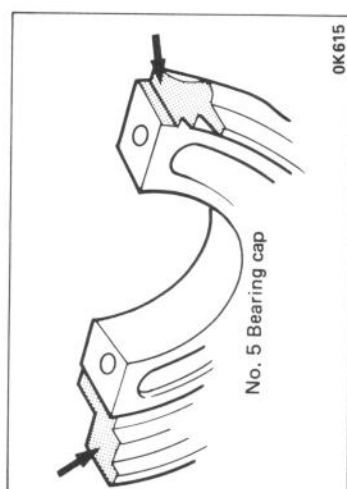
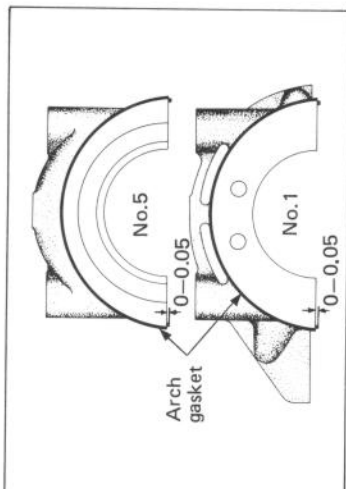
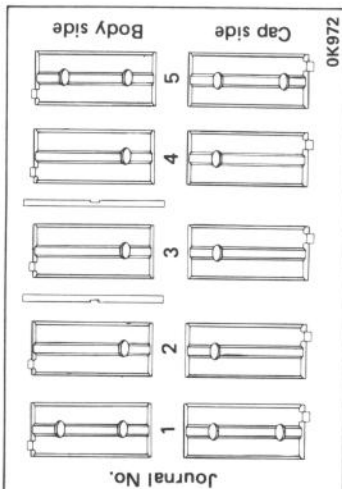
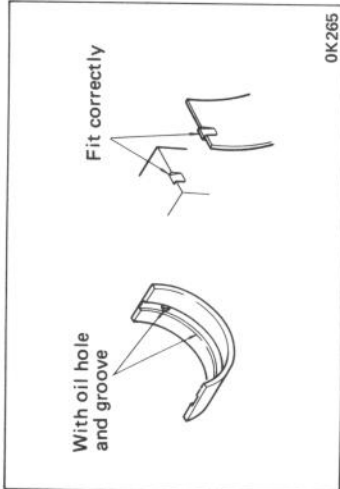
1. Crankshaft and bearing

The following points should be noted to avoid interchanging the crankshaft for C190 model engine with that from C240 model.

Journal diameter	(mm)	
	C190 model	C240 model
	60	70

Install the crankshaft after applying engine oil to the face of the bearing in contact with the crankshaft.

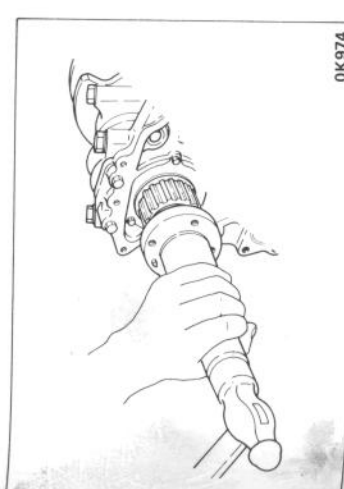
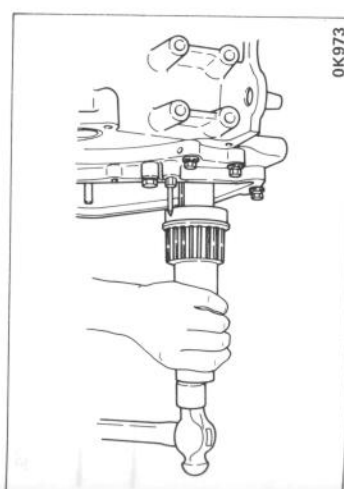
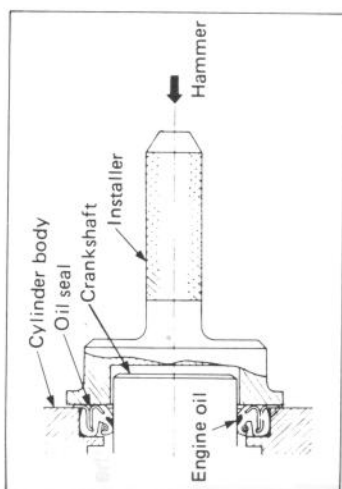
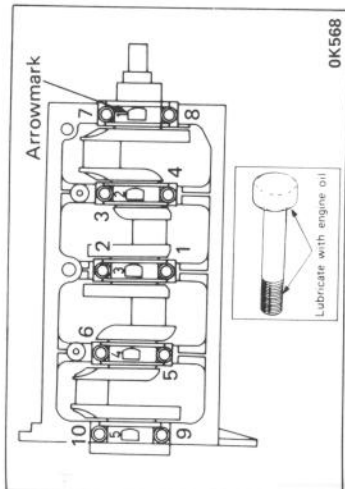
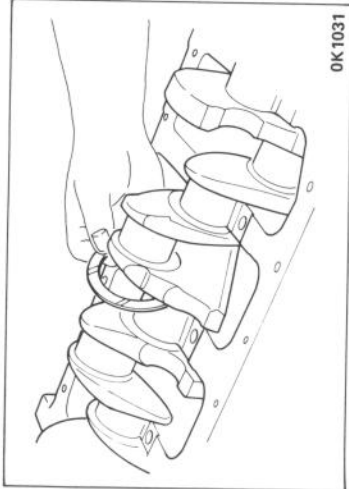
The bearings should be installed correctly in their respective position. Install the thrust bearing with the oil grooved side turned outward.



Apply a coat of silicone gasket evenly to the joining faces of the No. 5 bearing cap and cylinder body. The No. 1 and No. 5 bearing caps should be installed flush with the face of the cylinder body.

Installation of bearing cap arch gaskets
Install the arch gasket on the No. 1 and No. 5 bearing caps.

Amount of projection of gasket	(mm)
	0 — 0.05



Install front and rear side thrust bearings with the oil groove turned to the timing gear and flywheel, respectively.

Tighten crankshaft bearing cap bolts in numerical order.

Torque (kg-m)	16 — 18	
	(mm)	
Bolt length	C190GB, C190	89
	C240	97

2. Rear oil seal

Apply engine oil to the lipped portion of the rear oil seal, then install it in position using installer.

Installer : 9-8522-1279-0



5. Crankshaft timing pulley (C190GB only)

Installer : 9-8522-0021-0

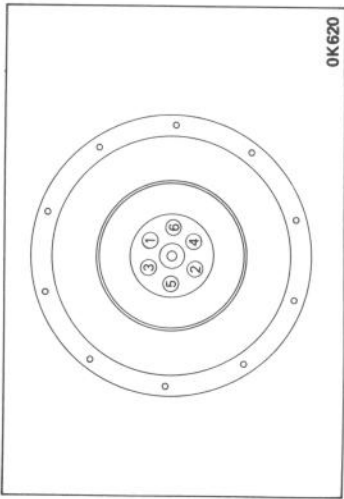


6. Crankshaft pulley center (C190GB only)

Installer : 9-8522-0021-0



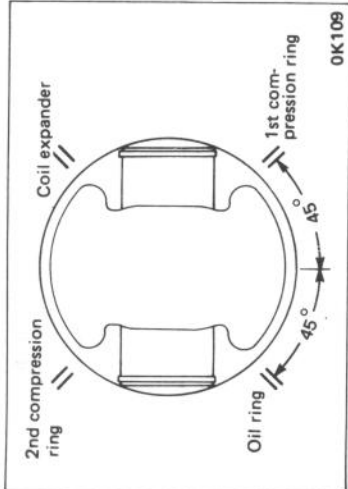
Torque (kg-m)	19.0	
	(mm)	



7. Flywheel

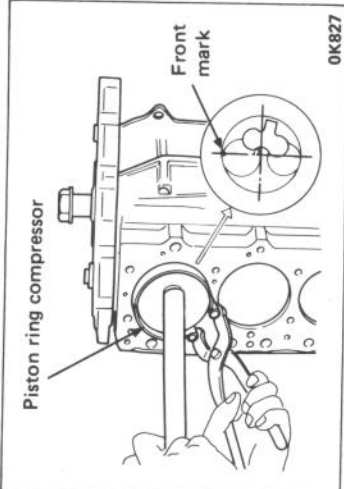
Tighten the bolts in the numerical order as the illustration.

Torque	(kg-m)
	12.0



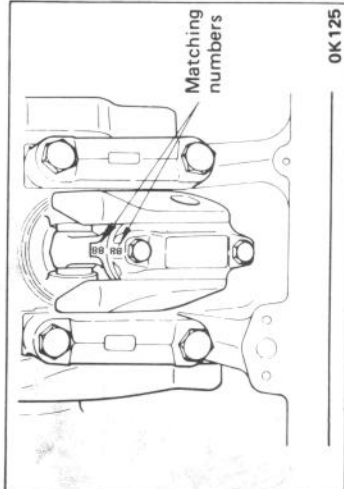
10. Piston and connecting-rod

Lightly oil the piston rings fitted to the piston, then position piston ring gaps as illustrated in the drawing.



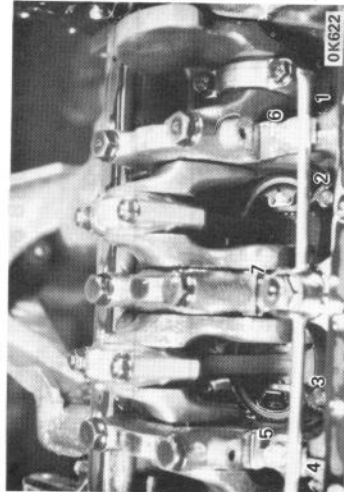
Piston ring compressor : 9-8522-1255-0

Install the piston and connecting-rod with mark turned to the front of engine.



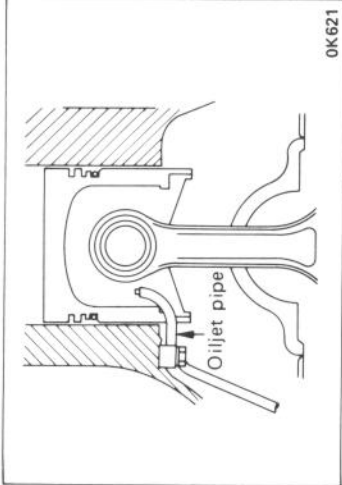
Install the connecting-rod bearing caps by matching numbers.

Torque	(kg-m)
	8.0 — 9.0

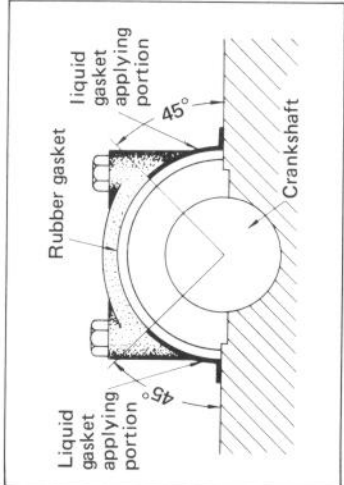


11. Oiling jet

Tighten oiling jet pipe fixing bolts in numerical sequence.



Turn the crankshaft and check to make certain oil jet pipe is apart from the piston.



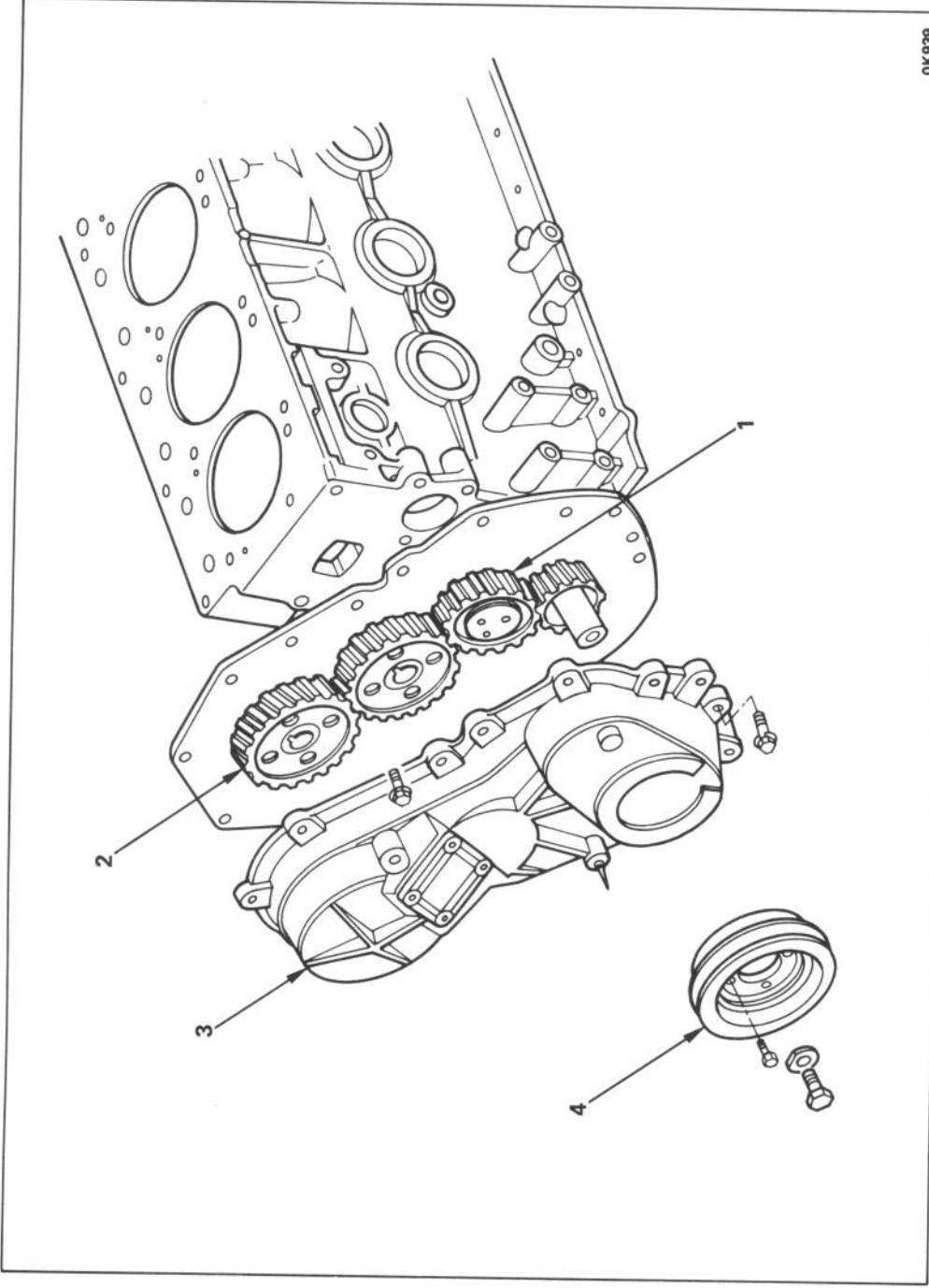
13. Crankcase

Apply liquid gasket to the arch gasket fitting face of the No. 1 and No. 5 bearing caps.

INTERNAL PARTS (Timing gear train)

MAJOR COMPONENTS

Gear drive type



Reassembly steps

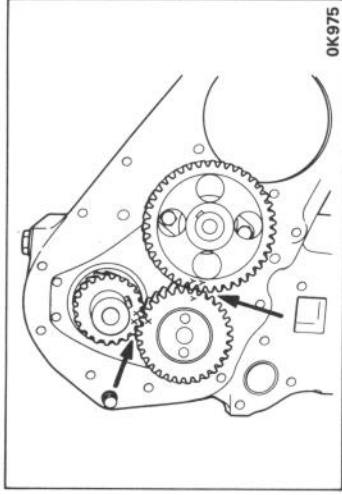
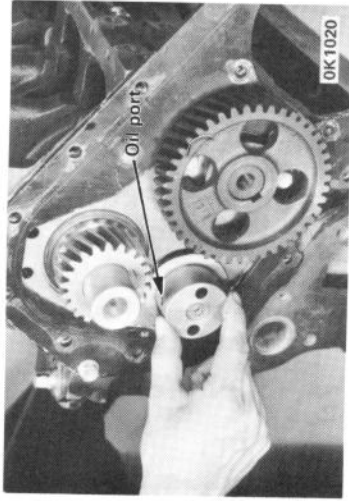
- ▲ 1. Idler gear assembly
- ▲ 2. Injection pump gear
- ▲ 3. Timing case cover
- ▲ 4. Damper pulley



Important operations

1. Idler gear

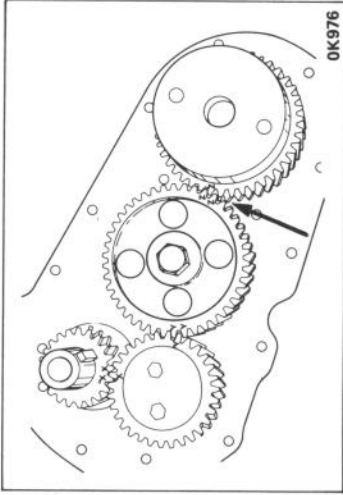
Install the idler gear, so that the oil port in the idler gear shaft is turned to the crankshaft gear side and bolt holes are aligned.



Align the marks on the camshaft gear, idler gear and crankshaft gear.

2. Injection pump gear

Install the injection pump gear together with injection pump by aligning the mark with that on the camshaft.

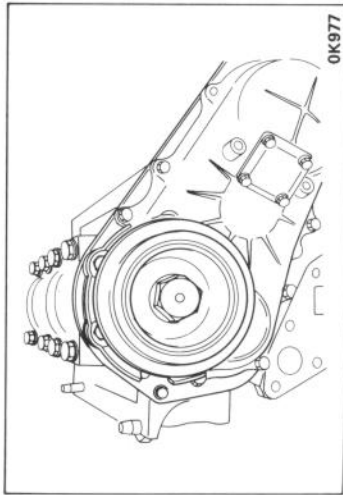


3. Timing case cover

Check to make certain the O-ring is fitted properly into ring groove in the timing gear case cover.



4. Pulley



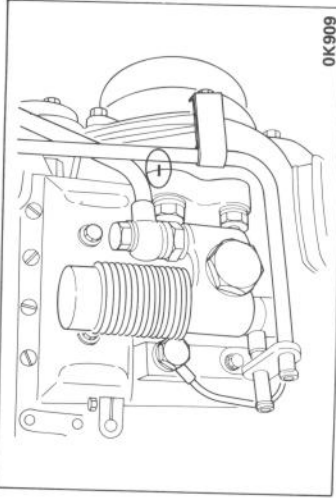
Torque	(kg-m)	19.0
--------	--------	------



Injection timing adjustment

Bring the piston in No. 1 cylinder to the injection timing before T.D.C. on compression stroke, so that TDC line on the pulley is aligned with the pointer.

Timing	C190	18°
	C240	14°



OK909



Bring the mark on the injection pump housing with the mark on the injection pump bracket.

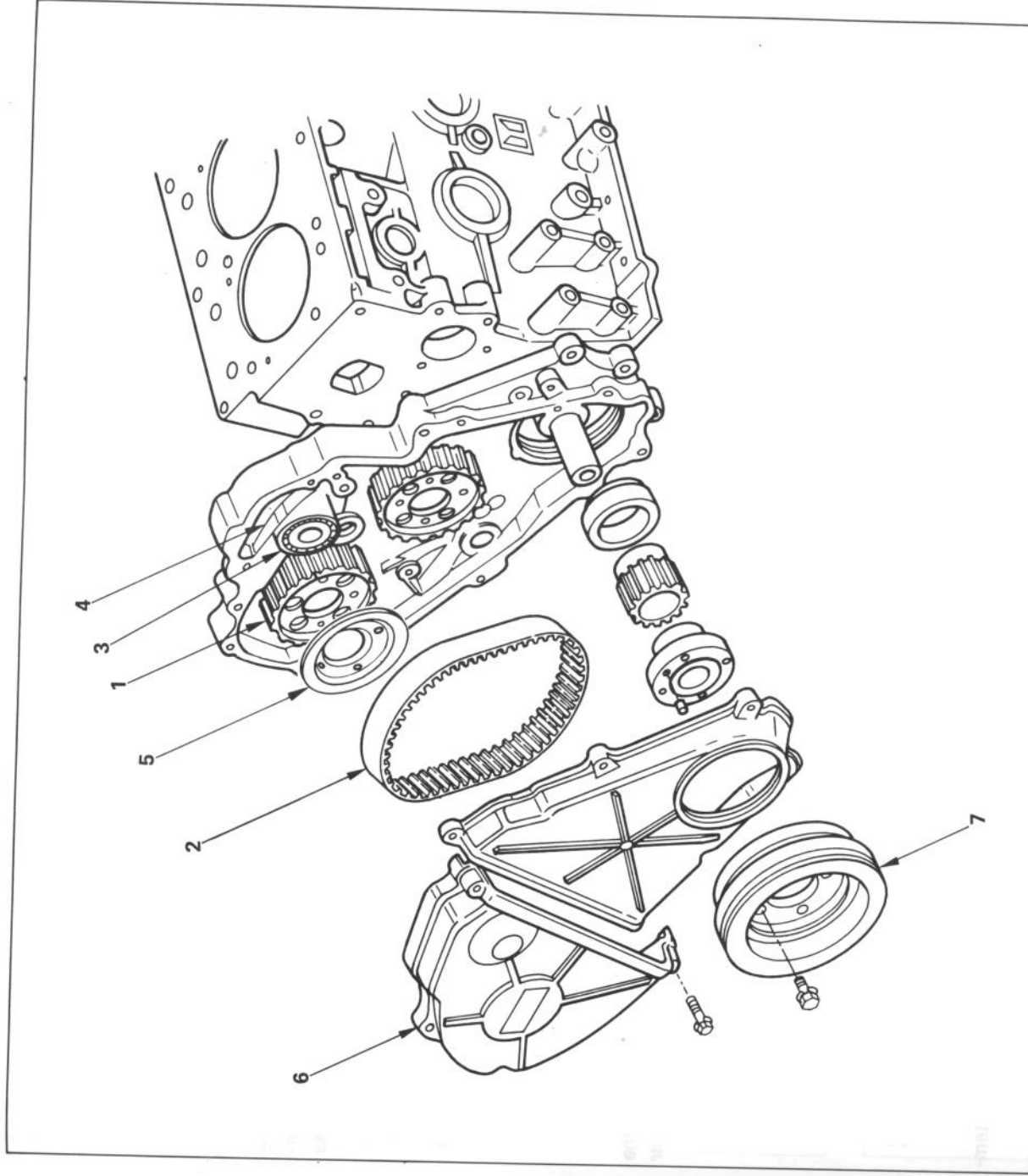
"QUALITY PARTS
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INTERNAL PARTS (Timing gear train)

MAJOR COMPONENTS

Belt drive type



OK942

Reassembly steps

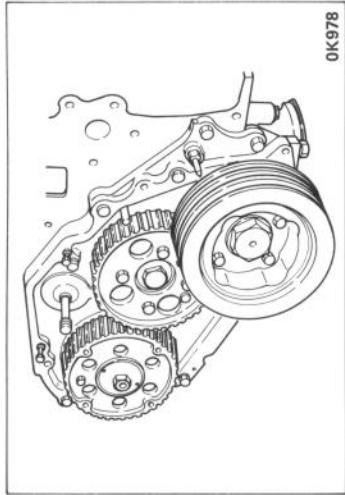
1. Injection pump gear
- ▲ 2. Timing belt
- ▲ 3. Tension bearing and center
- ▲ 4. Tension spring
- ▲ 5. Frange
6. Pulley housing cover
7. Pulley



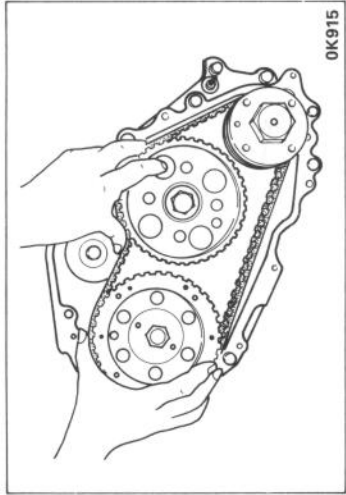
Important operations

2. Timing belt

Install the damper pulley and align the TDC mark on the pulley with the pointer and mark "▲" on the injection pump pulley with the mark "▲" on the camshaft timing pulley, then secure the injection pump timing pulley and camshaft timing pulley with bolts.

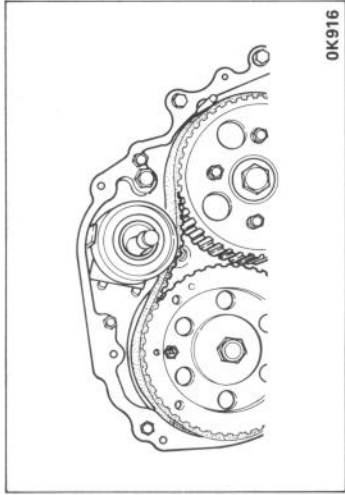


Remove the damper pulley and install the drive belt on the pulleys in sequence of the camshaft timing pulley, camshaft timing pulley and injection pump timing pulley. Collect slackness of the drive belt on the tension bearing.



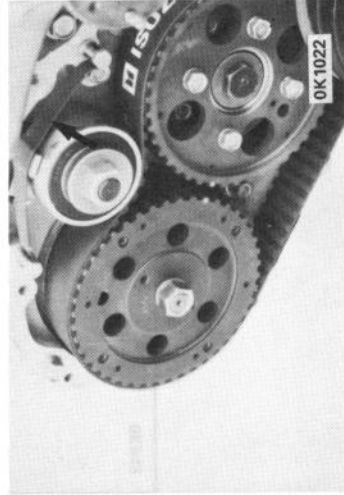
3. Tension bearing and center

Install the tension bearing and center by aligning the end of the tension center with the pins on the pulley housing, then finger tighten the tension bearing nut.

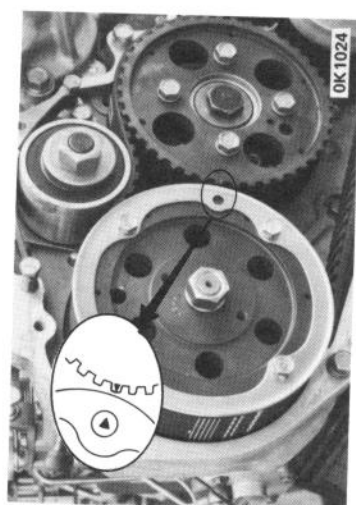
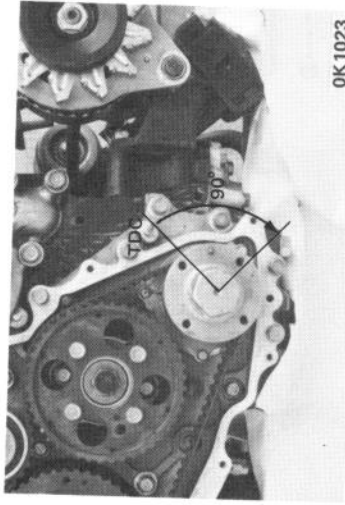


4. Tension spring

Install the tension spring properly.
Remove the pulley fixing bolts and set the tension bearing temporarily.



Torque	(kg·m)	3 — 5
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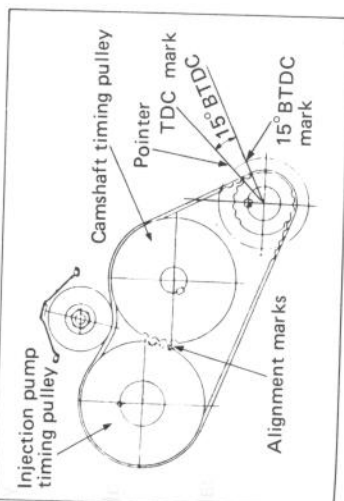
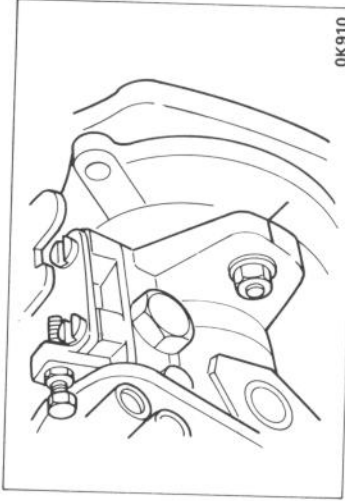


5. Flange

Install the flange by aligning the hole in the outer circumference of the flange with the timing mark "▲" on the injection pump. Turn the crankshaft two turns and check that the timing marks are in alignment.

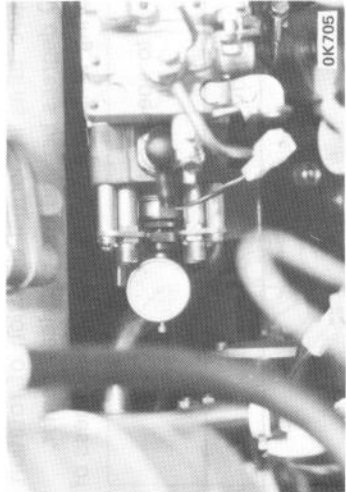
Timing adjustment

Check that notched line on the injection pump flange is in alignment with notched line on the front plate.



Bring the piston in No. 1 cylinder to top dead center on compression stroke by turning the crankshaft as necessary. With the front upper cover removed, check that timing belt is properly tensioned and that timing marks are aligned.

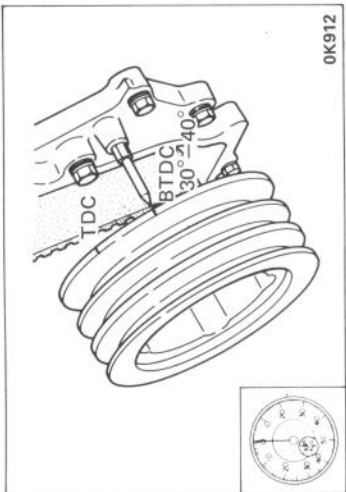
Torque	(kg·m)	11 — 13
--------	--------	---------



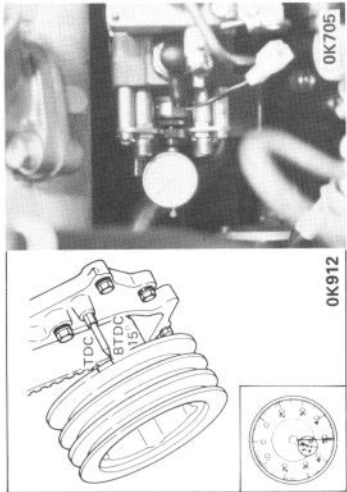
Disconnect the injection pipe from the injection pump and remove the distributor head screw, then install measuring device.

The dial indicator should be installed with the probe depressed inward by approximately 2 mm.

Measuring device



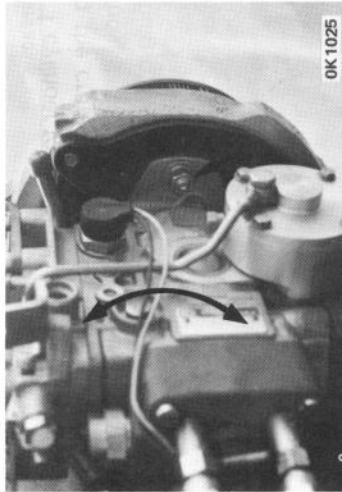
Bring the piston in No. 1 cylinder to a point 30° — 40° before top dead center by turning the crankshaft, then calibrate the dial indicator to zero.



Turn the crankshaft until the line 15° on damper pulley is brought into alignment with the pointer, then take reading of the dial indicator.

Timing	15°
Standard reading (mm)	0.47 — 0.53

Turn the crankshaft in normal direction of rotation.



If the injection timing deviates from the specified range, loosen pump fixing nuts and bracket bolts, then make an adjustment by varying injection pump setting angle.

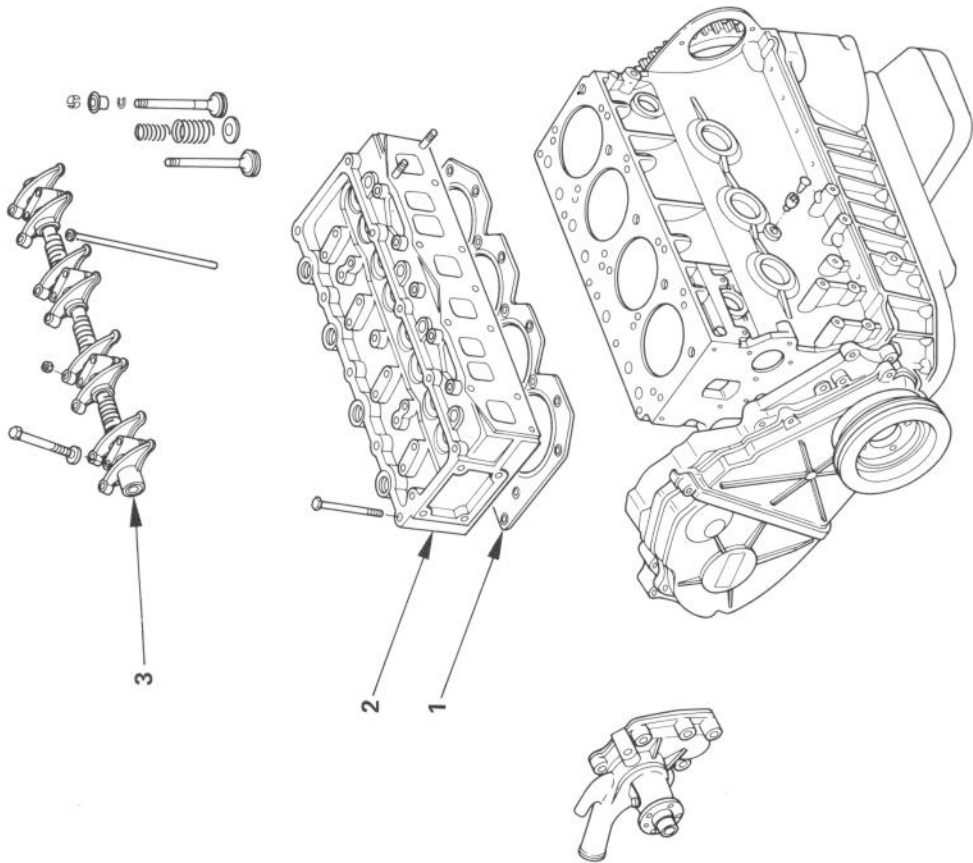
When larger than standard value:

Turn the injection pump toward the engine so that the dial gauge reads the standard value.

When smaller than standard value:

Turn the injection pump away from the engine so that the dial gauge reads the standard value.

INTERNAL PARTS II



Reassembly steps

- ▲ 1. Cylinder head gasket
- ▲ 2. Cylinder head

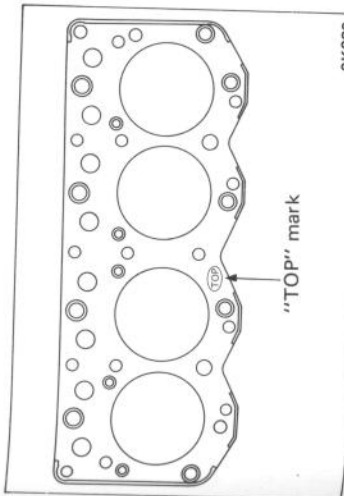
- ▲ 3. Rocker armshaft assembly
- 4. Water pump

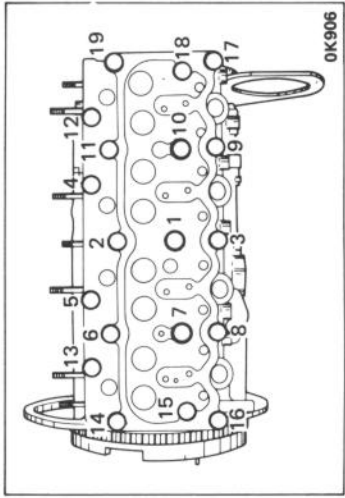


Important operations

- 1. Cylinder head gasket

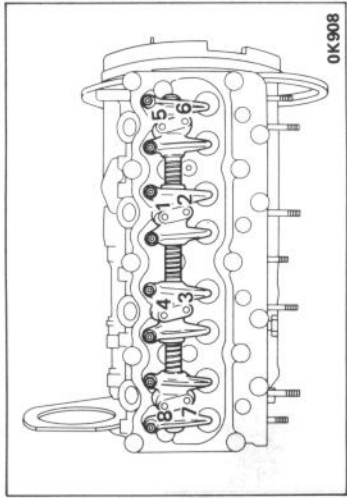
Install gasket with "TOP" mark side up on the cylinder body.





2. Cylinder head
Tighten cylinder head bolts in numerical sequence.

	1st step	2nd step
New bolt	6.5	8.0
Reused bolt	6.5	9.0



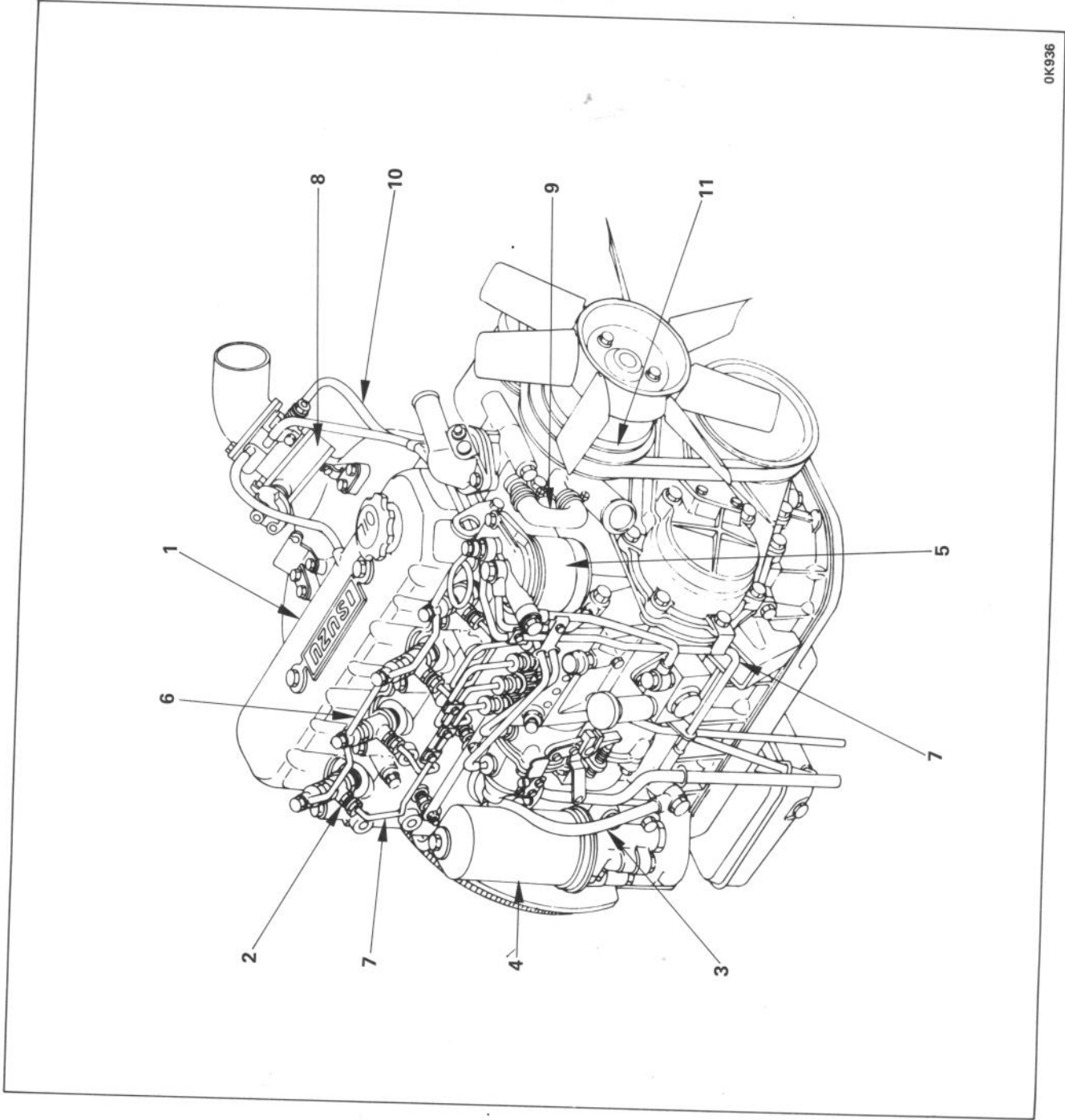
3. Rocker armshaft assembly
Tighten rocker armshaft bracket bolts in numerical order.

Rocker arm bracket torque (kg-m)	1.3 — 2.3
----------------------------------	-----------

Adjust the valve clearances referring to page 1-13.

EXTERNAL PARTS (Right hand side)

This illustration is based on the C240 model



Reassembly steps

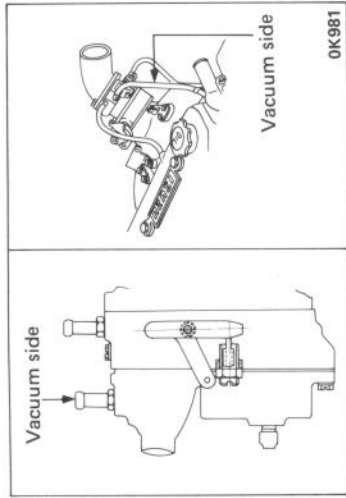
1. Cylinder head cover
2. Injection nozzle
3. Oil pipe : oil gallery to vacuum pump
4. Oil filter
5. Fuel filter
6. Leak off pipe
7. Fuel pipe
8. Intake shutter and throttle valve
9. Water hose
- ▲ 10. Vacuum hose
11. Fan pulley



Important operation

10. Vacuum hose

Connect red colored vinyl hose to the hose joint on the vacuum side.

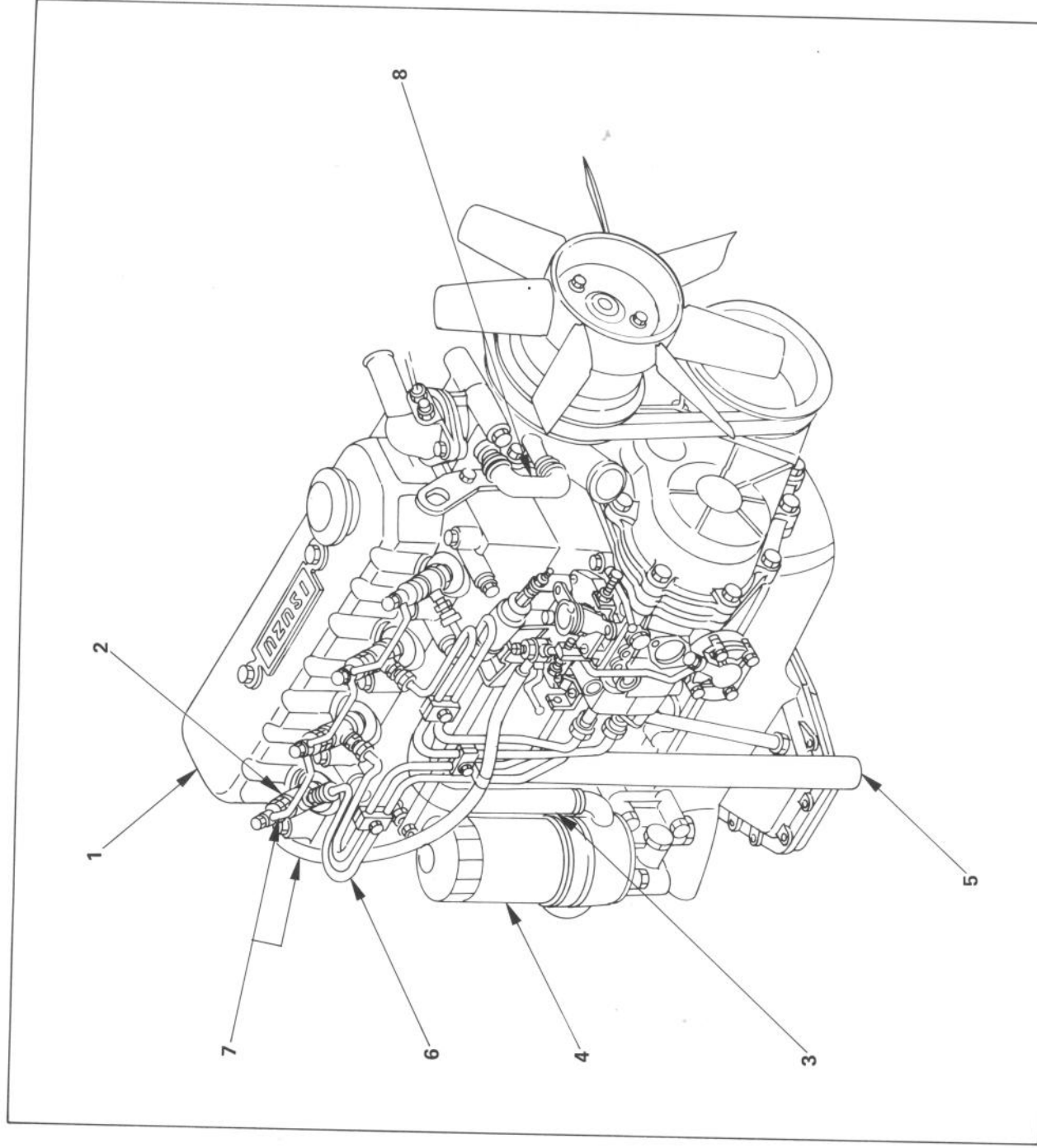


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EXTERNAL PARTS (Right hand side)

This illustration is based on the C190GB model

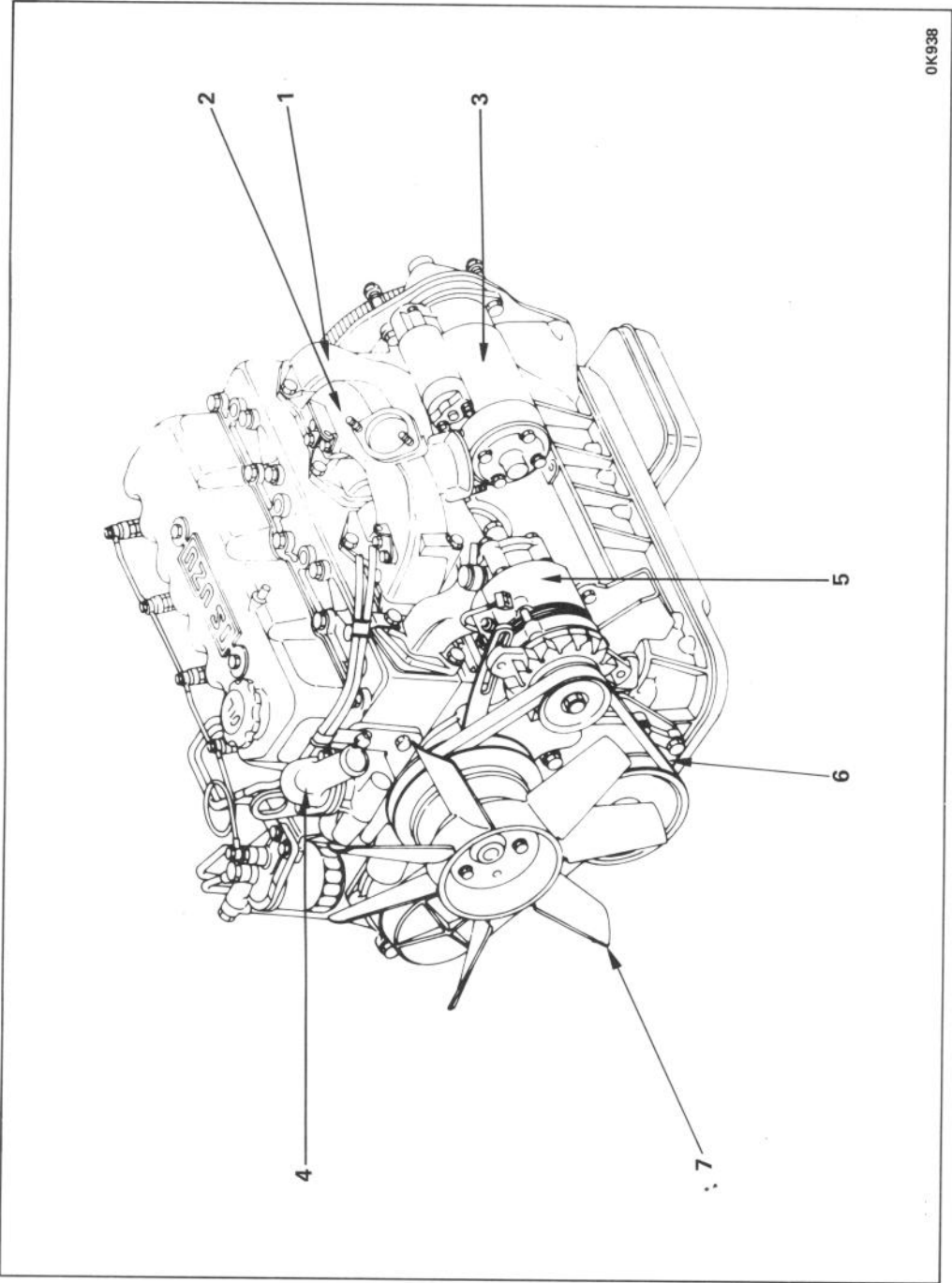


Reassembly steps

1. Cylinder head cover
2. Injection nozzle
3. Water hose
4. Oil filter assembly
5. Air breather hose
6. Injection pipe
7. Leak off pipe
8. Water hose

EXTERNAL PARTS (Left hand side)

This illustration is based on the C190 and C240 models.



OK938

Reassembly steps

- 1. Exhaust manifold
- 2. Intake manifold
- 3. Starter motor
- 4. Thermostat housing
- 5. Generator assembly
- ▲ 6. Fan belt
- 7. Cooling fan and spacer

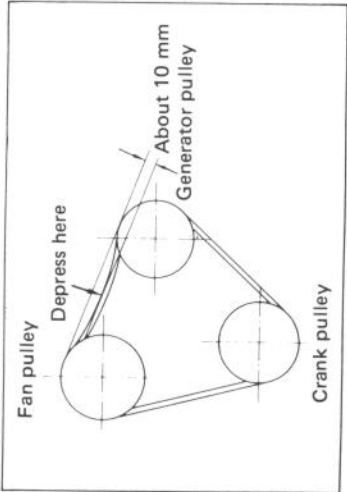


Important operation

6. Fan belt

Specified belt deflection

Fan belt	(mm)	10
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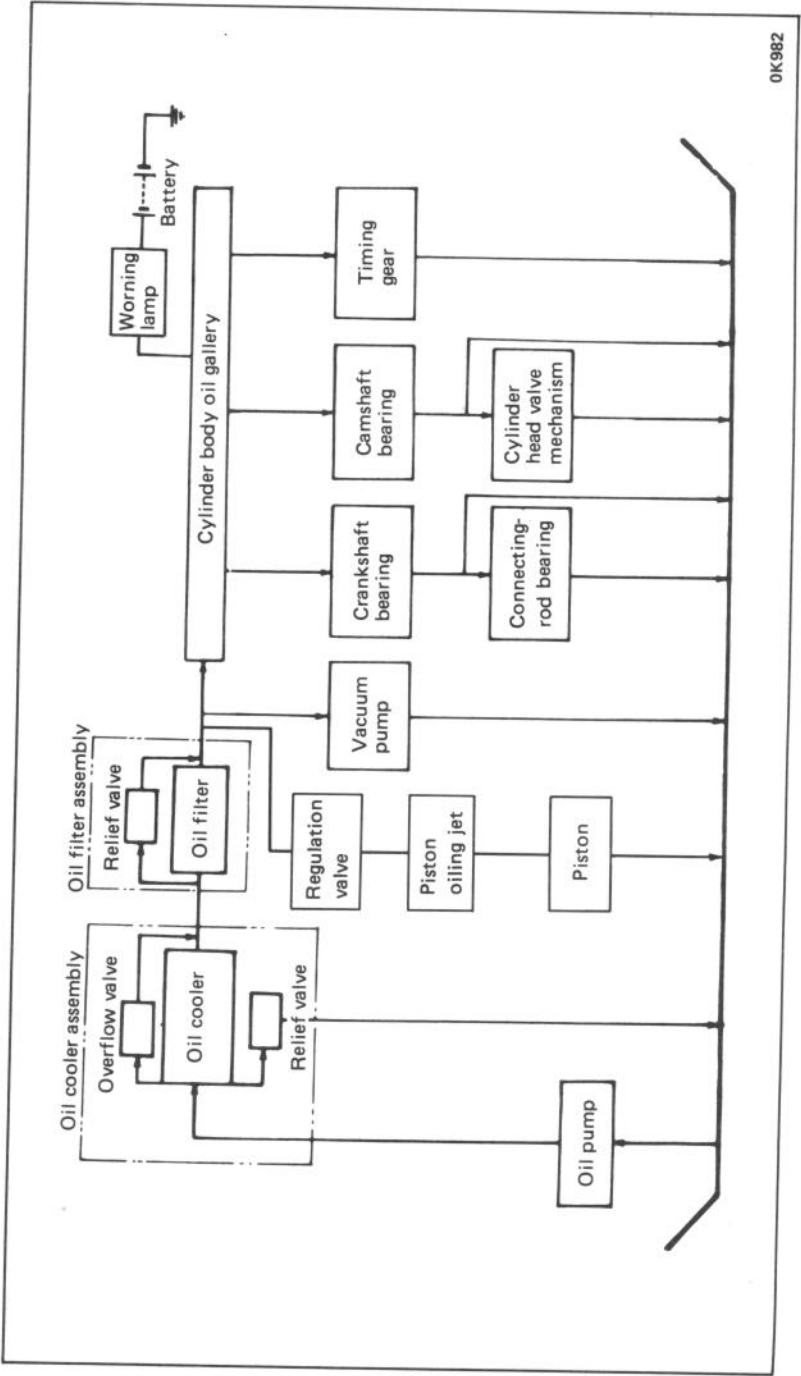
SECTION 3

LUBRICATING SYSTEM

INDEX

CONTENTS	PAGE
General description	3- 1
Oil pump	3- 2
With oil cooler type	3- 8
Oil cooler	3-10
Oil jet pipe and relief valve	3-10

GENERAL DESCRIPTION



OK982